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COMPARATIVE STUDY OF RANSONS CRITERIA AND MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX (MCTSI) IN PREDICTING COMPLICATIONS AND MORTALITY IN ACUTE PANCREATITIS

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INDEX

S. No.	Content	Page No.
1.	Introduction	1
2.	Aims & Objectives	4
3.	Review of Literature	5
4.	Materials & Methods	37
5.	Observations & Results	39
6.	Discussion	55
7.	Summary & Conclusion	65
8.	Bibliography	69
9.	Annexures	81

LIST OF ABBREVIATION

1. RANSON: Ranson's Criteria for predicting severity in acute pancreatitis.
2. CTSI: Computed Tomography Severity Index.
3. AP: Acute Pancreatitis.
4. MCTSI: Modified Computed Tomography Severity Index.
5. SIRS: Systemic Inflammatory Response Syndrome.
6. APACHE II: Acute Physiology and Chronic Health Evaluation II.
7. BUN: Blood Urea Nitrogen.
8. CRP: C-Reactive Protein.
9. WBC: White Blood Cell count.
10. CT: Computed Tomography.
11. ICU: Intensive Care Unit.
12. BMI: Body Mass Index.
13. SGPT: Serum Glutamic Pyruvic Transaminase (Alanine Aminotransferase).
14. Hb: Haemoglobin.
15. LOS: Length of Stay.

INTRODUCTION

INTRODUCTION

Acute pancreatitis is a medical condition defined by the abrupt onset of inflammation within the pancreatic tissue, leading to a broad spectrum of disease presentations. The severity of this condition varies considerably, ranging from mild cases, which are often self-limiting and resolve with supportive care, to severe acute pancreatitis (SAP). SAP is associated with a higher risk of complications, including systemic inflammatory response syndrome (SIRS), multiorgan failure, and other potentially life-threatening issues.

Prompt and accurate diagnosis, coupled with the assessment of disease severity, is crucial for optimizing patient management and improving clinical outcomes. Early identification of severity helps guide the selection of appropriate treatment strategies. While mild cases generally respond well to conservative management, such as hydration, pain management, and dietary modifications, cases classified as SAP often necessitate more intensive medical care. This includes aggressive fluid resuscitation, close monitoring in intensive care settings, and in some instances, surgical or interventional procedures to manage complications.[1]

Severe Acute Pancreatitis (SAP) is a life-threatening condition characterized by significant morbidity and a high mortality rate due to its numerous complications. Early identification of patients at risk of developing severe disease is critical, as it enables healthcare professionals to predict the disease trajectory and associated risks accurately. This foresight facilitates the implementation of timely and appropriate interventions, which are essential for improving patient outcomes. Prompt recognition of severe cases allows clinicians to focus on preventive measures and targeted treatments, reducing the likelihood of complications and minimizing mortality. Consequently, the ability to identify high-risk individuals early plays a pivotal role in SAP management.

Over the time, several scoring systems have been developed to aid in identifying patients with severe conditions and those at higher risk of complications and increased mortality. These systems incorporate a variety of criteria, including haematological, biochemical, radiological, clinical, and hemodynamic parameters, to ensure a comprehensive assessment of patient status. The primary objective of these scoring systems is to stratify risk effectively, guide clinical decision-making, and predict

outcomes in critically ill patients. Among the most commonly utilized scoring systems are:

1)Ranson's score is a widely utilized, it is a clinical scoring system designed to assess the severity and predict the prognosis of acute pancreatitis. This tool incorporates a set of 11 distinct criteria, each reflecting various physiological and metabolic changes associated with the disease. The parameters evaluated include the patient's age, initial blood glucose concentration, white blood cell (WBC) count, and levels of serum lactate dehydrogenase (LDH) and aspartate aminotransferase (AST). These variables are primarily measured upon the patient's admission to the hospital.

Additional factors assessed within the first 48 hours of hospitalization include the extent of haematocrit reduction, elevation in blood urea nitrogen (BUN), serum calcium levels, the partial pressure of oxygen (PaO2), base deficit, and the degree of fluid sequestration. Each parameter provides insight into the systemic response to pancreatic inflammation and associated complications.

The scoring system assigns one point for each criteria and the cumulative score helps classify patients into categories of mild, moderate, or severe pancreatitis. By evaluating these parameters at admission and during the critical early phase of hospitalization.

Ranson's score enables clinicians to stratify patients according to the severity of their condition. This stratification facilitates the selection of appropriate treatment strategies and aids in predicting patient outcomes, helping guide interventions to improve prognosis.

2) The Modified Computed Tomography Severity Index (CTSI**)** is a widely utilized radiological scoring system specifically developed to assess the severity of acute pancreatitis using computed tomography (CT) imaging. This scoring system evaluates three crucial components: pancreatic inflammation, extent of pancreatic necrosis, and the presence of extra-pancreatic complications, providing a detailed anatomical insight into the condition (Balthazar et al., 1994)[2,]. By integrating these parameters, the Modified CTSI delivers a comprehensive framework for evaluating the severity and extent of the disease, facilitating accurate diagnosis and management.

Different scoring systems are used to evaluate acute pancreatitis, each employing distinct methodologies. For instance, the Ranson's score, established by Ranson et al. in 1974,[3] relies on monitoring specific biochemical changes over a pivotal 48-hour period following admission. The biochemical approach provides a dynamic evaluation of the disease progression during the critical early phase.

On the other hand, the Modified CTSI score adopts a different perspective by focusing on structural and anatomical changes identified through CT imaging. The integration of these findings enables the Modified CTSI to offer a detailed radiological assessment that complements the biochemical analysis provided by Ranson's score (Banks et al., 2013).[4]

These distinct approaches—one emphasizing functional and biochemical changes, the other prioritizing structural and radiological findings—allow clinicians to comprehensively evaluate acute pancreatitis from multiple dimensions. This dual perspective is critical for devising patient-specific management strategies, improving prognosis, and tailoring interventions based on the severity of the condition.

NEED FOR STUDY

Acute pancreatitis is a commonly encountered condition in the Indian population. Early diagnosis of the disease helps in reducing complications and mortality rate. This study is essential to determine the effectiveness and accuracy of Ranson criteria and Computed Tomography Severity Index in assessing the severity and prognosis of the condition, which could potentially lead to improved patient outcomes and treatment strategies. If Ranson's scoring system proves effective, it may reduce the reliance on CT imaging in setting with limited access to advanced diagnostic facilities. This study aims to assess the system's efficacy and potentially provide a cost-effective alternative for diagnosing patients with limited resources.

AIMS AND OBJECTIVES

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AIMS: -

- To compare RANSON'S score and MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX score for predicting mortality and complications of acute pancreatitis.

Objective: -

1. To assess the RANSON'S score and MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX score for predicting mortality and complications such as pseudocyst, pancreatic necrosis, acute respiratory distress syndrome, organ failure in acute pancreatitis.
2. To compare efficiency of RANSON'S score and MODIFIED CTSI score for predicting mortality and complications of acute pancreatitis.
3. To evaluate demography of patients of acute pancreatitis.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

RANSON CRITERIA

The Ranson criteria is a widely recognized scoring system developed to evaluate the severity of acute pancreatitis using 11 distinct clinical and laboratory parameters. These parameters include age, white blood cell (WBC) count, blood glucose levels, serum aspartate transaminase (AST), serum lactate dehydrogenase (LDH), serum calcium, fall in hematocrit, arterial oxygen (PaO_2), blood urea nitrogen (BUN), base deficit, and fluid sequestration. Each of these parameters serves as an objective measure to predict the severity and potential complications associated with acute pancreatitis. By systematically evaluating these variables, clinicians are better equipped to identify cases at higher risk for severe outcomes.[5-7]

The criteria are named after **Dr. John Ranson,** a prominent surgeon and an authority in pancreatic diseases during the 20th century. He introduced this scoring system in his 1974 publication, titled Prognostic Signs and the Role of Operative Management in Acute Pancreatitis. In this groundbreaking study, **Dr. John Ranson** analysed data from 100 patients with acute pancreatitis to identify objective predictors of severe disease. His research concluded that 11 parameters hold significant prognostic value, forming the foundation of what is now known as the Ranson criteria. It is also important to note the existence of a modified version of these criteria. The original 11-parameter scoring system is specifically tailored to alcoholic pancreatitis, while the modified version, comprising 10 parameters, is used for evaluating gallbladder-related pancreatitis. This distinction underscores the adaptability of the criteria to different etiologies of acute pancreatitis.[7-9]

As one of the earliest scoring systems developed for acute pancreatitis, the Ranson criteria has become a cornerstone in clinical practice and remains widely utilized. Its enduring relevance highlights its utility in stratifying disease severity and guiding management decisions. Since its inception, however, the field has seen the development and validation of at least 17 additional scoring systems designed to predict outcomes in acute pancreatitis. Among these, notable prognostic tools include the Glasgow prognostic criteria, the APACHE II classification system, and the Balthazar CT-enhanced scoring system. Despite the availability of these newer systems, the Ranson

criteria continue to be a reliable and accessible method for clinical decision-making in acute pancreatitis management.

Ranson criteria is a widely recognized tool used to assess the severity and predict the mortality risk in cases of acute pancreatitis, particularly in alcoholic pancreatitis. These criteria involve the evaluation of specific clinical and laboratory parameters, divided into two assessment phases: one at admission and the other at 48 hours post-admission. Each positive parameter scores one point, culminating in a maximum score of 11 in the original criteria. A modified version of the criteria, which includes 10 parameters, simplifies the assessment by evaluating five parameters at admission and the remaining five at the 48-hour mark. These scoring systems aid clinicians in estimating disease severity and guiding management strategies to improve outcomes.

TABLE 1: RANSON'S SCORE

	Nonbiliary Acute Pancreatitis	**Biliary Acute Pancreatitis**
Admission		
Age (yr)	>55	>70
WBC count (×1000/mm3)	>16	>18
Glucose (mg/dl)	>200	>220
AST (IU/L)	>250	>250
LDH (IU/L)	>350	>400
Within 48 Hours of Admission		
Hematocrit decrease (%)	>10	>10
BUN increase (mg/dl)	>5	>2
Deficit in base(mEq/L)	>4	>5
Fluid replaced (L)	>6	>4
PaO2 (mm Hg)	<60	<60
Calcium (mg/dl)	<8	<8

SCORE ≥3 IS SUGGESTIVE OF SAP.

For the original Ranson criteria, the parameters assessed upon admission include the following: age greater than 55 years, a white blood cell (WBC) count exceeding 16,000 cells/cm³, blood glucose levels above 200 mg/dL (11 mmol/L), serum aspartate aminotransferase (AST) levels greater than 250 IU/L, and serum lactate dehydrogenase (LDH) levels surpassing 350 IU/L. At the 48-hour mark, six additional parameters are measured to gauge disease progression: serum calcium levels dropping below 8.0 mg/dL (<2.0 mmol/L), a haematocrit reduction greater than 10%, partial pressure of oxygen (PaO2) falling below 60 mmHg, an increase in blood urea nitrogen (BUN) by 5 mg/dL or more (≥1.8 mmol/L) despite intravenous fluid resuscitation, a base deficit exceeding 4 mEq/L, and sequestration of fluids exceeding 6 litres. This comprehensive approach ensures a systematic evaluation of disease severity, providing crucial insights into the prognosis and tailoring of therapeutic interventions.[10-12]

MODIFIED RANSON CRITERIA

The modified Ranson criteria serves as an essential tool for evaluating the severity of gallstone induced pancreatitis. This scoring system is divided into two sets of parameters, assessed at different time intervals to determine the risk of complications and prognosis. Upon admission, five key parameters are considered: the patient's age must be greater than 70 years, the white blood cell (WBC) count should exceed 18,000 cells/cm, blood glucose levels must surpass 220 mg/dL (equivalent to >12.2 mmol/L), serum aspartate aminotransferase (AST) levels should be above 250 IU/L, and serum lactate dehydrogenase (LDH) levels need to exceed 400 IU/L. These factors provide an early indication of disease severity.

At 48 hours after admission, five additional parameters are evaluated to monitor the progression of the condition. These include a serum calcium level falling below 8.0 mg/dL (<2.0 mmol/L), a haematocrit drop exceeding 10%, an increase in blood urea nitrogen (BUN) by 2 mg/dL or more (≥0.7 mmol/L) despite adequate intravenous fluid resuscitation, a base deficit greater than 5 mEq/L, and fluid sequestration surpassing 4 liters. These combined criteria help clinicians stratify patients based on their risk, enabling timely and appropriate interventions to improve outcomes.

TABLE 2: MODIFIED RANSON'S SCORE

	Nonbiliary Acute Pancreatitis	**Biliary Acute Pancreatitis**
Admission		
Age (yr)	>55	>70
WBC count (×1000/mm3)	>16	>18
Glucose (mg/dl)	>200	>220
AST (IU/L)	>250	>250
LDH (IU/L)	>350	>400
Within 48 Hours of Admission		
Hematocrit decrease (%)	>10	>10
BUN increase (mg/dl)	>5	>2
Deficit in base(mEq/L)	>4	>5
Fluid replaced (L)	>6	>4
Calcium (mg/dl)	<8	<8

SCORE ≥3 IS SUGGESTIVE OF SAP.

Score Interpretation

The risk of mortality can be stratified based on a scoring system, with each score range correlating to a distinct probability of death. For individuals scoring between 0 and 2 points, the associated mortality risk is relatively low, ranging from 0% to 3%. As the score increases to 3 or 4 points, the mortality risk rises significantly, reaching approximately 15%. Further elevation in scores, between 5 and 6 points, indicates a substantial increase in risk, with mortality rates climbing to around 40%. The highest scores, ranging from 7 to 11 points, are associated with an almost certain fatality rate, nearing 100%. [12] These stratifications highlight the importance of early assessment and appropriate interventions to mitigate risks, especially in patients with higher scores.

Issues of Concern

The Ranson criteria have certain limitations compared to other scoring systems for predicting the severity of acute pancreatitis. A 2016 meta-analysis reported that while a Ranson score greater than 2 demonstrated a median sensitivity and specificity of 90%

and 67.4%, respectively, other scoring systems outperformed it in either sensitivity or specificity. For instance, an APACHE-II score above 7 achieved a median sensitivity of 100%, whereas a BISAP score greater than 2 had a median specificity of 87.6%. Another meta-analysis on severity scoring systems for acute pancreatitis showed that a Ranson score above 2 had a sensitivity of 86.6% and a specificity of 87.2%. Additionally, Ranson et al. reported that a Ranson score greater than 2 yielded a sensitivity of 84.2% and a specificity of 89.8%.

A second limitation is the inability to determine the score and severity of acute pancreatitis until 48 hours after admission, which restricts its applicability in settings such as the emergency department. Moreover, the Ranson criteria involve 11 parameters, making it less convenient to use. In contrast, other scoring systems, such as APACHE-II and BISAP, can be applied immediately and are particularly suitable for critical care and emergency medicine.

A third limitation pertains to the demographic scope of the original study, which included individuals aged 30 to 75 years. Consequently, the Ranson criteria is not validated for use in paediatric or adolescent populations. A study by Lautz et al. highlighted this limitation, reporting a sensitivity of 51.8% and a negative predictive value of 83.2% for paediatric cases.

Research conducted in high-altitude regions suggested that the Ranson criteria might not be reliable in such settings. The modified scoring system used in these studies reduced the false warning rate from 38% to 15.9%, improving prediction accuracy in high-altitude environments.[13]

Clinical Significance

The Ranson criteria is primarily utilized in inpatient care settings to assess the severity of acute pancreatitis and guide clinical decision-making regarding the necessity for operative interventions. These criteria emphasize factors associated with multiorgan failure, systemic inflammatory response syndrome (SIRS), and vascular leakage, making them particularly relevant in predicting disease progression and outcomes.[12] A Ranson score of 0 or 1 indicates a low risk of complications, suggesting that the likelihood of mortality is extremely low or negligible. On the other hand, a Ranson score of 3 or higher signifies a higher probability of severe acute pancreatitis and an

increased risk of mortality. The classification of severe acute pancreatitis is based on the presence of organ failure or specific local complications affecting the pancreas, such as the formation of pseudocysts, pancreatic abscesses, or necrotic tissue. These complications represent significant challenges in managing the condition and contribute to its severity.

Other Issues

To overcome the limitations of the Ranson criteria, additional parameters are utilized to assess the severity of acute pancreatitis. Elevated blood urea nitrogen (BUN) levels at the time of admission have been linked to an increased severity of the condition and a higher risk of mortality. This elevation is thought to indicate intravascular volume depletion caused by inflammatory mediators during the acute inflammatory process. The APACHE score offers a key advantage over the Ranson criteria as it allows for patient evaluation at any point during hospitalization. However, its major limitation is that it requires considerable effort to calculate.

Haematocrit is a commonly used laboratory parameter for staging acute pancreatitis. A haematocrit level above 47% upon admission has been found to predict pancreatic necrosis effectively. Other biomarkers, such as C-reactive protein (CRP) and interleukin-6, are also used in staging the disease. Additionally, some novel biomarkers, including trypsinogen activation peptide, phospholipase A2, and polymorphonuclear elastase, have shown potential in predicting disease severity, though CRP remains a reliable marker.

Imaging is generally unnecessary for evaluating patients with mild acute pancreatitis unless malignancy is suspected. However, in severe cases, an abdominal CT scan is recommended as the preferred imaging technique, particularly for identifying complications. Routine CT imaging within the first three days of admission is typically avoided unless the diagnosis is uncertain, as inflammatory changes may not yet be visible. In cases of severe acute pancreatitis, image-guided aspiration may be needed to distinguish between sterile necrosis and purulent infection.

Outcomes

The Ranson criteria have been utilized for decades to evaluate the severity of acute pancreatitis. However, debates persist regarding its sensitivity and specificity. Managing patients with acute pancreatitis requires multi-disciplinary approach, including a gastroenterologist, surgeon, endocrinologist, and radiologist. For patients with moderate to severe cases, ICU nurses play a crucial role in monitoring their condition. Alternative scoring systems are available and can also be employed to assess the severity of the disease. It is important not to solely depend on the Ranson criteria but to complement its use with clinical judgment.[14]

MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX (MCTSI)

Acute pancreatitis is typically categorized into two primary forms: mild and severe. Mild pancreatitis, also known as interstitial or oedematous pancreatitis, is generally characterized by minimal organ dysfunction and a smooth, uncomplicated recovery process. This form often resolves effectively with supportive care and seldom leads to significant complications. In contrast, severe pancreatitis, referred to as necrotizing pancreatitis, occurs in approximately 20% of individuals diagnosed with acute pancreatitis. This severe form is associated with critical complications such as persistent organ failure, tissue necrosis, infections, or the development of pseudocysts.[15]

The classification of acute pancreatitis based on its severity has significant clinical implications. Determining the severity of the condition is essential for guiding management strategies and predicting outcomes. Mild pancreatitis usually shows a favourable response to conservative treatment, requiring only supportive interventions such as fluid resuscitation and pain management. On the other hand, severe pancreatitis necessitates more intensive medical interventions, close monitoring in an intensive care setting, and specialized therapeutic approaches. This form is also associated with a higher risk of morbidity and mortality, warranting a more cautious and proactive management approach to improve patient outcomes.[16,17]

An ideal method for prognostication in pancreatitis should possess characteristics that ensure it is reliable, user-friendly, and universally accessible. It should demonstrate

minimal variability between different observers and be applicable during the early stages of the disease. This early applicability is crucial for identifying patients at risk of developing severe complications, enabling clinicians to implement closer monitoring or initiate timely interventions such as aggressive fluid resuscitation to mitigate potential adverse outcomes.[18,19]

Since 1974, numerous clinical and imaging-based scoring systems have been devised to facilitate this objective. These include Ranson's criteria, which was among the earliest methods introduced to assess the severity of acute pancreatitis.[20] Subsequently, the Acute Physiology and Chronic Health Evaluation (APACHE II) scoring system was developed, offering a broader application in assessing the severity of illnesses, including pancreatitis, based on physiological and chronic health data.[21] Moreover, the CT severity index (CTSI) has emerged as a valuable radiologic tool, combining imaging findings with clinical parameters to provide an accurate evaluation of disease severity and potential complications.[22,23]

The Computed Tomography (CT) severity index, introduced by Balthazar and colleagues in 1994,[22,23] represents a crucial advancement in assessing acute pancreatitis. This index aids clinicians in classifying pancreatitis into mild, moderate, and severe forms based on specific imaging findings. It evaluates the extent of pancreatic inflammation and necrosis, assigning a score on a 10-point scale. This scoring system incorporates both the presence and extent of fluid collections as well as the degree of pancreatic necrosis.

One significant limitation of the CT severity index is its limited correlation with the progression to organ failure,[24] the occurrence of extra pancreatic parenchymal complications,[25,26] or peripancreatic vascular complications.[27] This lack of correlation raises concerns about its ability to comprehensively predict clinical outcomes. It has been hypothesized that incorporating these complications into a revised version of the index could enhance its predictive accuracy.

Additionally, studies have highlighted challenges with interobserver agreement when using the original CT severity index. Research has shown that the agreement rate among observers is moderate, with approximately 75% consistency.[25, 28] This variability likely stems from the complexity involved in categorizing pancreatic inflammation and

necrosis, which involves multiple levels of classification (four or five categories each). These intricacies can lead to discrepancies in interpretation among clinicians.

To address these issues, a modified and simplified CT scoring system has been proposed and evaluated in patients with acute pancreatitis. The aim of this revised system is to improve the prediction of clinical outcomes, such as morbidity and mortality, while simultaneously enhancing interobserver reliability. By streamlining the scoring process and incorporating additional clinically relevant parameters, the modified index seeks to overcome the limitations of the original system and provide a more robust tool for clinical decision-making.

COMPONENTS OF MODIFIED CTSI SCORE:

TABLE 3: MODIFIED CTSI SCORE

PANCREATIC INFLAMMATION	**SCORE**
No inflammatory changes	0
Parenchymal inflammation and/or peri pancreatic fat stranding	2
Peri pancreatic collection	4
PANCREATIC NECROSIS	
No necrosis	0
<30% necrosis	2
>30% necrosis	4
EXTRA PANCREATIC COMPLICATION	
None	0
Ascites/pleural effusion/GI involvement	2

INTERPRETATION:

TABLE 4: INTERPRETATION OF MODIFIED CTSI SCORE

SCORE 0-2	Mild pancreatitis
Score 4-6	Moderate pancreatitis
Score 8-10	Severe pancreatitis

ACUTE PANCREATITIS

Acute pancreatitis is a prevalent condition and ranks as the leading cause of hospital admissions among gastrointestinal disorders. This condition involves the acute inflammation of the pancreas and presents with a wide spectrum of severity. While some cases are mild and respond well to conservative management, others progress to severe forms, characterized by significant complications and high rates of morbidity and mortality. Mortality rates in acute pancreatitis range from approximately 3% in mild oedematous pancreatitis to as high as 20% in cases involving pancreatic necrosis.[29] Although the initial diagnosis of acute pancreatitis is relatively straightforward, predicting its progression and eventual outcome poses a significant challenge. The duration and course of the disease are critical factors in determining the appropriate level of care required for the patient.[30-32]

The Atlanta classification categorizes acute pancreatitis into two main types. Interstitial oedematous acute pancreatitis is marked by inflammation of the pancreatic parenchyma and the surrounding peri-pancreatic tissues, while necrotizing acute pancreatitis involves the necrosis of both the pancreatic parenchyma and peri-pancreatic tissues.[33] Furthermore, based on the severity of the disease, acute pancreatitis is classified into three types. Mild acute pancreatitis is characterized by the absence of both local and systemic complications as well as organ failure. Moderately severe acute pancreatitis includes local complications, with or without transient organ failure lasting less than 48 hours. Severe acute pancreatitis, on the other hand, is defined by persistent organ failure lasting more than 48 hours, involving one or more organs.

An understanding of the anatomy and function of the pancreas is essential to comprehend the disease. The pancreas, a digestive gland, is located on the posterior abdominal wall in front of the L1 and L2 vertebrae. It spans transversely between the duodenum on the right and the spleen on the left, comprising four parts: the head, neck, body, and tail. The pancreatic head lies in close proximity to the inferior vena cava and the right renal vein, encircled by the duodenal loop, while the tail extends to the splenic hilum. The pancreas performs dual functions. Its exocrine function involves the secretion of pancreatic juice by acinar cells, which is delivered to the duodenum via the main and accessory pancreatic ducts. The endocrine function, involving the secretion of hormones like insulin and glucagon by the islets of Langerhans, directly regulates blood glucose levels.[34]

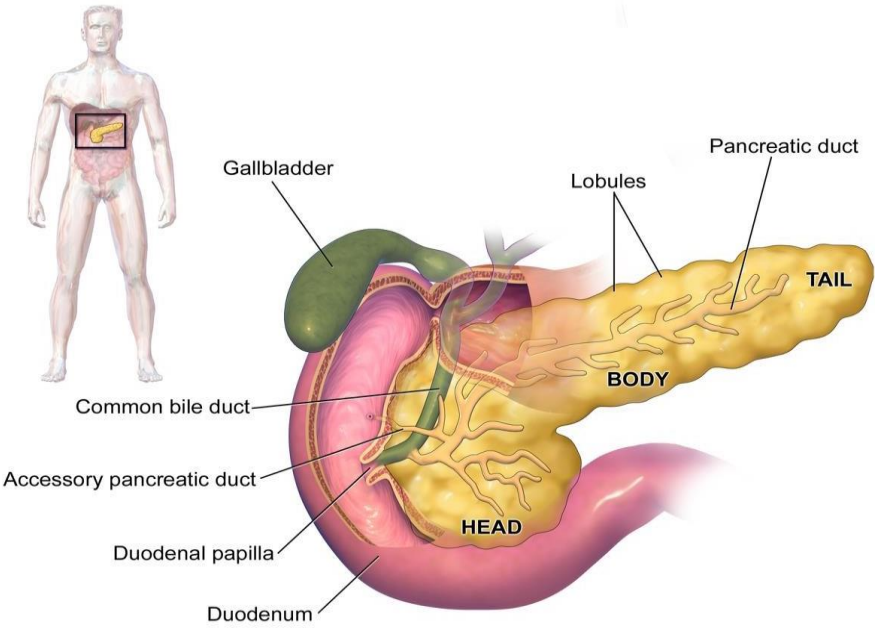

Figure 1: ANATOMY OF PANCREAS

Etiology

Acute pancreatitis is commonly caused by gallstones, alcohol consumption, and hypertriglyceridemia, although the prevalence of each etiology varies based on geographical location and socioeconomic factors. Additional causes include drug-induced pancreatitis, idiopathic cases, and post-procedural complications, such as those following endoscopic retrograde cholangiopancreatography (ERCP) or abdominal surgery. Structural abnormalities, like ampullary stenosis (formerly known as sphincter

of Oddi dysfunction type I), and autoimmune conditions, including type I autoimmune pancreatitis (associated with systemic IgG4 disease) and type II autoimmune pancreatitis, also contribute to the disease's development.

Infections play a significant role, with viruses such as Coxsackie, Cytomegalovirus, Echovirus, Epstein-Barr virus, and others like Hepatitis A, B, and C, HIV, Mumps, Rubella, and Varicella being implicated. Similarly, bacterial pathogens like Campylobacter jejuni, Legionella, Leptospira, Mycobacterium avium, Mycobacterium tuberculosi*s*, and Mycoplasma can trigger pancreatitis. Smoking, trauma, and congenital anomalies, such as an annular pancreas, are additional risk factors.

Genetic conditions, including hereditary pancreatitis, cystic fibrosis, and alpha-1 antitrypsin deficiency, have been identified as underlying causes in certain populations. Metabolic disturbances like hypercalcemia, parasitic infections (e.g., Ascaris lumbricoides, Cryptosporidium, Clonorchis sinensis, Microsporidia), renal disease requiring haemodialysis, and exposure to toxins (e.g., scorpion bites, organophosphate poisoning) are other recognized triggers. Finally, systemic inflammatory diseases such as vasculitis, including polyarteritis nodosa and systemic lupus erythematosus, also contribute to the multifactorial nature of acute pancreatitis. These etiologies underline the diverse mechanisms involved in the pathogenesis of the condition and highlight the need for a comprehensive diagnostic approach in its evaluation.[32,35,36]

Table 5: The causes of acute pancreatitis

Mechanical	**Toxic and Metabolic**	**Others**
Gall stones	Alcohol	Ischemia
Pancreatic duct obstruction	Hyperlipidaemias	Iatrogenic injury
Dysfunction of the sphincter of Oddi	Drugs	Infection
Trauma	Scorpion venom	Hereditary
Ampullary obstruction	Organophosphate poisoning	Autoimmune
Congenital malformations (annular pancreas)	Hypercalcemia	Cystic fibrosis

Increased triglycerides, fatty acids and ethyl ester.

↓

Formation of pancreatic juice which contains high enzymes but low enzyme inhibitors

↓

enzyme activation within pancreas; precipitation of proteins, intraductal plug formation, ductal hypertension and obstruction

↓

Formation of O2 free radicals inside the pancreas

↓

pancreatic acinar injury

↓

Sphincter of Oddi spasm by alcohol leading into ductal obstruction

↓

Repeated subclinical acute pancreatitis causes fibrosis and chronic pancreatitis

Epidemiology

The occurrence of acute pancreatitis is increasing globally. This trend may be linked to a genuine rise in cases or improved detection methods, with contributing factors such as the prevalence of metabolic syndrome and hypertriglyceridemia. Studies have highlighted an increasing number of acute pancreatitis cases attributed to hypertriglyceridemia. Acute pancreatitis is most common in individuals during their fifth and sixth decades of life, though mortality risk rises with advancing age. Variations in incidence are believed to result from geographic and socio-economic factors, primarily differences in alcohol consumption and the presence of biliary calculi, which are the leading causes of the condition.[37,38]

Pathophysiology

The pathophysiology of pancreatitis is characterized by localized pancreatic destruction and a systemic inflammatory response. A key triggering event is the premature activation of trypsinogen into trypsin within the acinar cells rather than in the duct lumen. This process is commonly caused by elevated ductal pressures (e.g., due to duct obstruction) and disruptions in calcium homeostasis and pH levels. Toxins linked to

pancreatitis often lead to ATP depletion, resulting in increased intra-acinar calcium concentrations. This rise in calcium levels can prematurely activate trypsinogen, leading to the activation of enzymes like elastase and phospholipases.

The premature activation of these zymogens causes significant tissue damage and the release of Damage-Associated Molecular Patterns (DAMPs). These DAMPs recruit neutrophils and initiate an inflammatory cascade. This cascade contributes to the systemic effects of acute pancreatitis, including increased capillary permeability and endothelial damage. These changes, combined with microvascular thrombosis, may progress to multi-organ dysfunction syndrome (MODS), which is a leading cause of morbidity and mortality in acute pancreatitis.

In some cases, individuals may have a genetic predisposition to pancreatitis, experiencing recurrent acute episodes that may progress to chronic pancreatitis. Genes associated with this condition often influence the activation of trypsinogen. For instance, mutations in the CFTR (cystic fibrosis transmembrane conductance regulator) gene, gain-of-function mutations in the PRSS1 (cationic trypsinogen) gene, and mutations in the trypsin-degrading enzyme CTRC (chymotrypsin C) or SPINK1 (pancreatic secretory trypsin inhibitor) gene are implicated. These genetic factors are increasingly recognized as contributing to the continuum of diseases from acute to chronic pancreatitis.[31, 39,40]

Evaluation

Acute pancreatitis is diagnosed based on the Revised Atlanta Classification, which requires meeting at least two of the following three criteria: elevated levels of lipase or amylase exceeding three times the upper limit of normal, abdominal pain characteristic of pancreatitis, and imaging findings consistent with acute pancreatitis.

Amylase and lipase are two key enzymes commonly measured in the evaluation of acute pancreatitis, but they have different diagnostic utilities:

Amylase

Source: Produced mainly by the pancreas and salivary glands.
Elevated in acute pancreatitis: Typically rises within 6–12 hours of symptom onset.
Duration: Returns to normal within 3–5 days.

Limitations:

Less specific to the pancreas (can be elevated in other conditions like salivary gland disorders, intestinal obstruction, perforated ulcer, etc.).

Mildly elevated levels may occur in many non-pancreatic conditions.

Lipase

Source: Primarily produced by the pancreas.

Elevated in acute pancreatitis: Rises within 4–8 hours after symptom onset.

Duration: Remains elevated longer—up to 8–14 days.

Advantages:

More specific to pancreatic injury than amylase.

Preferred enzyme for diagnosis of acute pancreatitis.

Diagnostic Use

Both enzymes are usually elevated to >3 times the upper limit of normal in acute pancreatitis.

Lipase is generally preferred due to higher sensitivity and specificity.

Enzyme levels do not correlate with the severity of pancreatitis.

Identifying the underlying cause of acute pancreatitis involves a thorough initial assessment and laboratory investigations. The initial evaluation includes a detailed medical history focusing on symptoms indicative of gallstone disease, unexplained weight loss, recent-onset diabetes, history of alcohol consumption, medication use, prior surgical procedures or trauma, hypertriglyceridemia or hypercalcemia, autoimmune diseases, or a family history of recurrent acute pancreatitis. Laboratory investigations should include serum triglycerides, calcium, and liver biochemical tests, alongside genetic testing for patients with a strong family history of the condition. Imaging modalities such as abdominal ultrasound are essential for detecting choledocholithiasis or bile duct dilatation, while chest radiographs are useful in moderate to severe cases to evaluate for pleural effusions, a marker of higher disease severity and mortality risk. In cases where the diagnosis remains unclear, a computed tomography (CT) scan with intravenous contrast is advised to confirm or exclude pancreatitis. Additionally, CT scans are indicated for patients who show no

improvement or deterioration after 48 hours of fluid resuscitation to assess for complications such as necrosis.

Table 6: Approach for assessing the patient

History	Gallstone disease, Alcohol abuse, Medication use, History of weight loss, New-onset diabetes, Previous surgery or trauma, Hypertriglyceridemia or hypercalcemia, Autoimmune disease, Genetic causes
Examination	Fever, Tachycardia, Epigastric tenderness or palpable mass in the epigastric area, Jaundice, Cullen's sign, Turner's sign
Laboratory Evaluation	Elevated serum amylase and lipase levels (3-5 times normal), Elevated white blood cell count, Elevated serum triglycerides, Hypocalcemia, Elevated serum bilirubin, AST, ALT, LDH, and alkaline phosphatase
Imaging	Chest and abdominal X-rays, Abdominal ultrasound, CT abdomen
Serological Test	IgG4

When the cause of pancreatitis remains unclear despite initial evaluations, it is advisable to seek input from a gastroenterology specialist. Advanced diagnostic procedures, such as magnetic resonance cholangiopancreatography (MRCP) or endoscopic ultrasound (EUS), may be necessary. MRCP, being a non-invasive technique, poses no perioperative risks and does not require contrast agents; however, its sensitivity is limited in detecting biliary stones smaller than 3 mm and early-stage chronic pancreatitis. Due to these limitations, EUS is often preferred. If MRCP and EUS are not accessible, computed tomography (CT) with a pancreatic protocol may be utilized as an alternative. Routine diagnostic endoscopic retrograde cholangiopancreatography (ERCP) is generally avoided and is instead reserved for therapeutic interventions in cases where abnormal findings are identified through MRCP or EUS.[41-43]

Treatment / Management

Early and aggressive fluid resuscitation forms the cornerstone of acute pancreatitis management. Lactated Ringer's solution is the preferred fluid, administered initially as

a bolus of 15–20 mL/kg, followed by a continuous infusion at 3 mL/kg per hour (approximately 250–500 mL per hour) within the first 24 hours, provided there are no contraindications to fluid administration. Monitoring of fluid resuscitation is carried out through laboratory parameters such as blood urea nitrogen, haematocrit, and urine output, checked every 4–6 hours during the initial 24-hour period to guide adjustments in fluid rates. Lack of response to initial fluid resuscitation indicates a significant risk of developing multiple organ dysfunction syndrome (MODS) and warrants escalation of care.[44-46] However, a recent randomized controlled trial (RCT) revealed that aggressive fluid resuscitation might increase the risk of fluid overload without providing significant clinical benefits in outcomes.[47,48]

Nutritional management is another vital aspect of treating acute pancreatitis. Traditionally, patients are kept nil per oral (NPO) until symptoms such as abdominal pain, nausea, vomiting, appetite loss, and ileus subside. However, recent studies support the safety of early feeding in mild pancreatitis, as it does not aggravate symptoms. An initial diet comprising soft, low-residue, and low-fat foods is recommended, which can be transitioned to a regular diet as tolerated. In cases of severe pancreatitis or when oral intake is not feasible, nasojejunal feeding is preferred over parenteral nutrition, as it helps maintain the integrity of the intestinal wall and reduces bacterial translocation. Routine prophylactic antibiotics are generally unnecessary, but in cases of suspected infection, empiric antibiotics can be initiated until culture results confirm the causative organism. Antibiotic use is reserved for confirmed infected necrosis.

Pain management is also a critical component of acute pancreatitis treatment.[49] Most patients experience abdominal pain during the disease course. While some guidelines lack explicit recommendations for pain management, others emphasize the importance of assessing pain and providing appropriate pharmacological therapy, though they often omit specific details regarding the type, dose, route, and frequency of analgesics.[50-52] The World Health Organization (WHO) analgesic ladder is commonly used to guide pain management, starting with non-steroidal anti-inflammatory drugs (NSAIDs) and progressing to potent opioids and interventional strategies when needed. Among the available analgesics, opioids like fentanyl and meperidine, as well as NSAIDs, are frequently employed. Pain management follows the World Health Organization (WHO) analgesic ladder, which is structured into four distinct steps as illustrated in the following table:

Table 7: WHO Analgesic Ladder

Step 1	NSAID
Step 2	Low potent opioid ± NSAID ± adjuvant drugs
Step 3	High powerful opioid ± NSAID ± adjuvant drugs
Step 4	Interventional treatment ± high potent opioid ± NSAID ± adjuvant drugs[53]

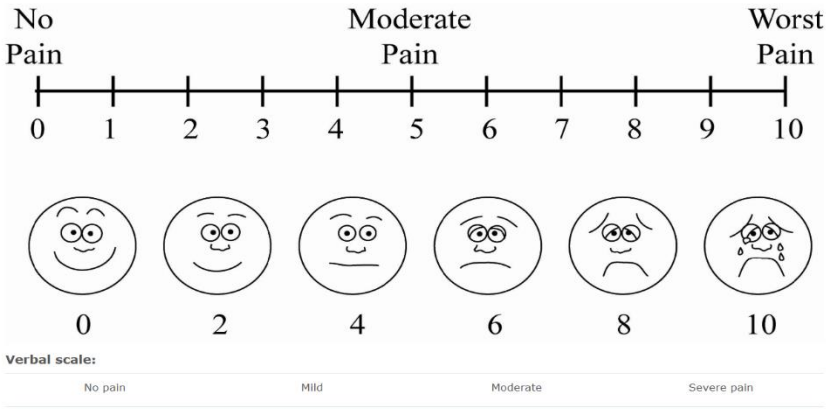

Figure 2: VAS Pain Scale

Previously, opioids were thought to cause spasms of the sphincter of Oddi. However, a recent Cochrane review analysing five randomized controlled trials (RCTs) involving 227 patients found no significant difference between opioids and other analgesics in terms of complications or severe adverse events.[54] Similarly, a meta-analysis by Stigliano et al. concluded that there is no reliable evidence to avoid using morphine for pain relief in acute pancreatitis.[55]

Further treatment of acute pancreatitis focuses on addressing its cause. For gallstone pancreatitis, early cholecystectomy is strongly recommended. In cases of concurrent cholangitis or significant biliary obstruction, early endoscopic retrograde cholangiopancreatography (ERCP) within 24 hours is beneficial. For mild or self-resolving biliary pancreatitis, ERCP is performed if an intraoperative cholangiogram shows a distal biliary filling defect during cholecystectomy. In hypertriglyceridemia-induced pancreatitis, the goal is to lower triglycerides to less than 500 mg/dL using treatments like apheresis or insulin infusion with or without glucose supplementation.

Complications of acute pancreatitis are classified as early (within 4 weeks, such as peripancreatic fluid collection and necrosis) or late (beyond 4 weeks, such as pancreatic pseudocysts and walled-off necrosis). Most peripancreatic fluid collections resolve spontaneously, with less than 10% progressing to pseudocysts. Observation with regular follow-up using CT or MRI is sufficient for most pseudocysts, but drainage is required in cases of infection or rapid growth. Drainage methods include endoscopic (transmural or transpapillary) and percutaneous approaches, with the endoscopic method preferred.

Managing necrotic collections is complex. Sterile necrosis is treated only if it causes symptoms such as persistent abdominal pain, nausea, vomiting, or gastrointestinal obstruction. Approximately one-third of necrosis cases become infected, leading to clinical worsening, prolonged recovery, and high mortality. Suspected infections are treated with antibiotics, typically a carbapenem or a combination of quinolone, cefepime, or ceftazidime with metronidazole. Imaging findings of gas bubbles or culture from CT-guided aspiration confirm infection. Surgical necrosectomy is reserved for patients whose condition worsens despite antibiotics. Stable patients are treated with antibiotics for 4 to 6 weeks, delaying necrosectomy until the necrosis wall matures. Minimally invasive techniques, such as endoscopic or percutaneous drainage, are preferred initially, with surgical debridement considered if these fail .[56,57]

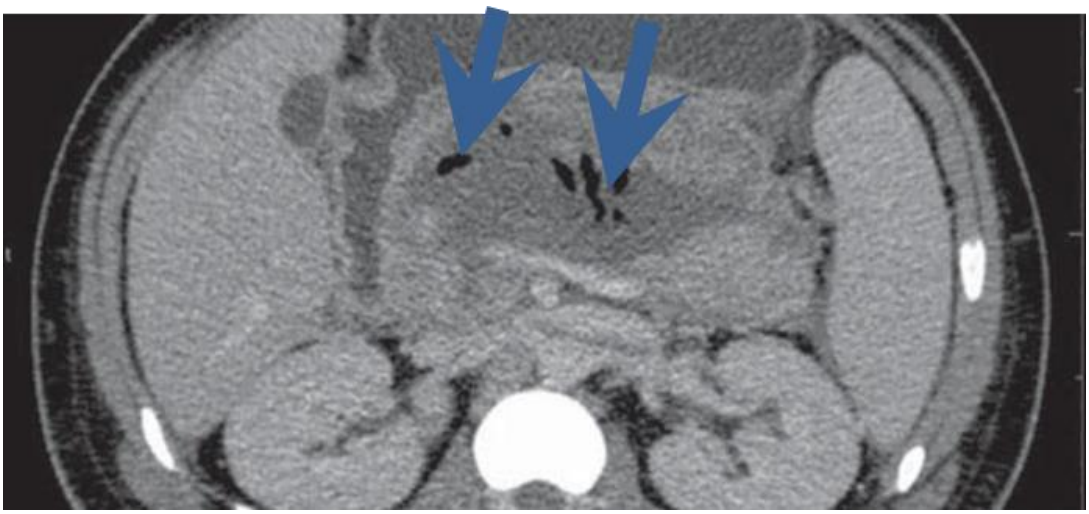

Figure 3: PANCREATIC NECROSIS ON CT SCAN

Differential Diagnosis

The differential diagnosis for abdominal pain includes various conditions, with acute pancreatitis being a key consideration. A focused history and physical examination are crucial for narrowing down to a specific diagnosis. Differential diagnoses for acute pancreatitis include peptic ulcer disease, cholangitis, cholecystitis, bowel obstruction, bowel perforation, mesenteric ischemia, acute hepatitis, diabetic ketoacidosis, basilar pneumonia, myocardial infarction, aortic dissection, and renal colic. In many cases, a lipase level elevated to three times the upper limit of normal is highly specific for diagnosing pancreatitis as the cause of abdominal pain. Imaging studies further aid in differentiation; for instance, abdominal ultrasound is useful for identifying cholecystitis, while a CT angiogram is indicated when mesenteric ischemia is suspected. Additionally, in high-risk patients presenting with atypical epigastric pain, a cardiac source must be excluded. Although the pain from an aortic dissection is typically severe and tearing, it must be considered due to its life-threatening urgency.

Table 8: Differential Diagnosis of Acute Pancreatitis

Acute Cholecystitis	Diabetic Ketoacidosis
Peptic Ulcer Disease	Myocardial Infarction
Aortic Dissection	Bowel Perforation
Obstruction of Common Bile Duct	Renal Colic
Intestinal Ischemia or Infarction	Bowel Obstruction
Acute Hepatitis	Cholangitis

Pertinent Studies and Ongoing Trials

A randomized controlled trial (RCT) published in the New England Journal of Medicine was conducted across 18 centres to compare aggressive versus moderate fluid resuscitation using lactated Ringer's solution in patients with acute pancreatitis. In the aggressive fluid resuscitation group, patients received an initial bolus of 20 ml/kg body weight followed by maintenance fluids at 3 ml/kg/hour. Conversely, the moderate resuscitation group received a bolus of 10 ml/kg only in hypovolemic patients, or no bolus in normovolemic patients, with maintenance fluids at 1.5 ml/kg/hour. Fluid therapy adjustments were made at 12, 24, 48, and 72 hours based on the patients' clinical status.

Fluid Resuscitation Protocol Flowchart

Patient Assessment

↓

Determine Resuscitation Group

- **Aggressive Resuscitation**

Initial Bolus: **20 ml/kg**

Maintenance: **3 ml/kg/hour**

- **Moderate Resuscitation**

If Hypovolemic: **Bolus 10 ml/kg**

If Normovolemic: **No Bolus**

Maintenance: **1.5 ml/kg/hour**

↓

Clinical Monitoring & Fluid Adjustment

- Evaluations at **12, 24, 48, and 72 hours**
- Adjust therapy based on clinical status

The primary outcome measured was the development of moderately severe or severe acute pancreatitis, while fluid overload was assessed as the primary safety outcome. The interim analysis included 249 participants, but the trial was terminated early due to significant differences in safety outcomes between the groups. Fluid overload occurred in 20.05% of patients receiving aggressive resuscitation compared to 3% in the moderate group (adjusted relative risk: 2.85; 95% CI: 1.36–5.94; P = 0.004). The study concluded that aggressive fluid resuscitation led to a higher risk of fluid overload without a corresponding improvement in clinical outcomes.[47]

Prognosis

The mortality rate of acute pancreatitis is generally around 1-2%, but severe acute pancreatitis is associated with a significantly higher, though undefined, mortality rate. Accurate severity assessment and prognosis are crucial for determining appropriate care. Existing clinical prediction scales, though validated, are complex and require data over 48 hours. According to the guidelines by the International Association of Pancreatology and the American Pancreatic Association, the presence of systemic inflammatory response syndrome (SIRS) at admission, which persists for 48 hours, is

indicative of severe acute pancreatitis.[58] Persistent SIRS correlates with a 25% mortality rate compared to 8% for transient SIRS.[59] The sensitivity and specificity of persistent SIRS for predicting mortality are reported to be 77-89% and 79-86%, respectively, while SIRS at admission shows 100% sensitivity but only 31% specificity.[60,61]

The Bedside Index for Severity in Acute Pancreatitis (BISAP) is a more recent and simpler tool for predicting the severity and mortality of acute pancreatitis. It is easy to calculate from initial presentation data and has been validated through prospective studies. While the BISAP score demonstrates superior specificity compared to older systems like the Ranson criteria and APACHE II score, its sensitivity for predicting mortality and severe acute pancreatitis is suboptimal.[62] A BISAP score of 0-2 indicates a low mortality risk of less than 2%, whereas a score of 3-5 signifies a higher mortality risk exceeding 15%.

Table 9: BISAP Score

Parameter	**Criteria**
BUN	BUN > 25 mg/dL (8.9 mmol/L) (1 point)
Impaired mental status	Abnormal mental status with Glasgow coma score <15 (1 point)
SIRS	Evidence of SIRS (Systemic inflammatory response syndrome) (1 point)
Age	Age > 60 years (1 point)
Pleural effusion	Pleural effusion on imaging studies (1 point)

The Modified CT Severity Index (CTSI) combines the Balthazar score with the assessment of pancreatic necrosis to evaluate the severity of acute pancreatitis. It is a valuable tool for predicting mortality and identifying pancreatic necrosis, which is associated with higher mortality risk [35]. The score ranges from 0 to 10, categorizing the severity of pancreatitis: 0–2 indicates mild, 4–6 indicates moderate, and 8–10 indicates severe, thereby assisting in grading and guiding treatment decisions.

Table 10: Modified CT Severity Index (CTSI)

Prognostic Indicator	**Points**
Pancreatic Inflammation	
1. Normal pancreas	0
2. Intrinsic pancreatic abnormalities with or without inflammatory changes in peripancreatic fat	2
3. Pancreatic or peripancreatic fluid collection and peripancreatic fat necrosis	4
Pancreatic Necrosis	
1. None	0
2. Less than or equal to 30%	2
3. Greater than 30%	4
Extra parenchymal Complications (1 or more of the following complications: pleural effusions, abdominal ascites, vascular complications, parenchymal or gastrointestinal tract involvement)	2

Complications

Severe pancreatitis is associated with a range of complications, including abdominal compartment syndrome, acidosis, acute renal failure, acute respiratory distress syndrome, ascites, bowel infarction, chronic pancreatitis, disseminated intravascular coagulation, and haemorrhagic pancreatitis. Additionally, complications such as gastric varices, ileus, mesenteric venous thrombosis, pancreatic abscess, pancreatic arterial pseudoaneurysm, pancreatic necrosis, pseudocyst formation, and splenic venous thrombosis can also occur. These complications highlight the severity of acute pancreatitis and the potential for multi-organ involvement, emphasizing the need for intensive care and close monitoring of affected patients.

Consultations

Consultations commonly requested for patients with acute pancreatitis include those from a general surgeon, radiologist, gastroenterologist, intensivist, pulmonologist, and endocrinologist. Each specialist contributes their expertise to manage the various aspects of the condition, from surgical interventions to imaging, respiratory care, and endocrine function. These consultations help in providing comprehensive care and optimizing patient outcomes.

Deterrence and Patient Education

Patients should be educated on factors that could worsen their condition. They should avoid attempting to drive themselves to a healthcare facility in the event of an attack. If alcohol contributes to their pancreatitis, they need assistance in stopping alcohol consumption. Adherence to prescribed medications is crucial. A low-fat diet is recommended, and a dietician can help with meal planning and menu suggestions. Patients should also learn how to monitor their pulse and recognize when medical attention is needed based on their readings. Additionally, they should contact their healthcare provider if they experience symptoms such as fever, severe abdominal pain, nausea, vomiting, dizziness, jaundice (indicated by yellowing of the skin or eyes), a rapid pulse, shallow breathing, or abdominal swelling or tenderness.

Pearls and Other Issues

The pathophysiology of acute pancreatitis is primarily driven by the early activation of pancreatic enzymes, such as zymogen and trypsinogen, which causes local pancreatic injury and initiates an inflammatory response. This response triggers the systemic inflammatory response syndrome (SIRS), commonly seen in acute pancreatitis. SIRS can progress to multiorgan dysfunction syndrome (MODS). According to the Revised Atlanta Criteria, the diagnosis of acute pancreatitis requires at least two of the following three conditions: 1) serum lipase or amylase levels that are three times above the normal limit, 2) clinical signs consistent with pancreatitis, and 3) imaging findings (such as CT, MRI, or ultrasound) suggestive of acute pancreatitis.

The Bedside Index Severity in Acute Pancreatitis (BISAP) score is a useful tool for determining the severity of acute pancreatitis and guiding patient management. It has been validated prospectively and is considered reliable in predicting both severe acute pancreatitis and mortality. The score is easy to calculate using data collected at the patient's initial presentation. The first 12 to 24 hours of hospitalization are crucial for managing acute pancreatitis. Proper fluid resuscitation during this period can significantly reduce complications and improve outcomes, with close monitoring of vital signs and laboratory results to ensure effective treatment.

Approximately 10 to 20% of acute pancreatitis cases are classified as idiopathic, posing challenges for diagnosis and management. Recent research focuses on optimizing the use of endoscopic ultrasound (EUS) and endoscopic retrograde cholangiopancreatography (ERCP) in these cases, with a more cautious approach to ERCP due to its relatively high risk of causing post-procedural pancreatitis. A recent randomized controlled trial (RCT) published in *The New England Journal of Medicine* involved 18 centers and assessed patients with acute pancreatitis. Participants were assigned to either a goal-directed aggressive fluid resuscitation or a moderate fluid resuscitation protocol using lactated Ringer's solution. The trial found that aggressive fluid resuscitation led to a higher incidence of fluid overload without improving clinical outcomes.

Enhancing Healthcare Team Outcomes

Acute pancreatitis is a serious condition that requires a multidisciplinary approach for optimal management. The most effective treatment involves a team of healthcare professionals, such as surgeons, radiologists, endocrinologists, pulmonologists, intensivists, gastroenterologists, pharmacists, nurses, and addiction specialists. The primary causes of acute pancreatitis include gallstones, alcohol consumption, and certain medications. Prevention is a key focus in managing this condition. Nurses and pharmacists play a crucial role in educating patients on reducing their risk by abstaining from alcohol, losing weight, adopting a low-fat diet, and managing their lipid levels. Pharmacists can also review the patient's medications and suggest discontinuing those that may contribute to pancreatitis.[64-66] Effective communication and careful documentation by all team members are essential to ensure that patient information is accurate and up-to-date, promoting coordinated care. This collaborative approach results in the best possible outcomes for patients.

Outcomes

Acute pancreatitis is a severe illness with a mortality rate ranging from 5% to 15%, influenced by factors such as the underlying cause, patient age, and comorbidities. Gallstone-induced pancreatitis generally has a higher mortality rate compared to alcoholic pancreatitis. The presence of type 2 diabetes further elevates the risk of complications and death. In cases of multiorgan involvement, mortality rates may reach 20%. Most fatalities are attributed to multiorgan failure and hypotensive shock. Several classification systems have been proposed to assess prognosis in acute pancreatitis, although many are not practical for routine use.[67-69]

Bollen et al. (2011)[70] focused on evaluating the modified CTSI (MCTSI) in comparison to the standard CTSI and APACHE II scoring systems in assessing AP severity. Their study involving 397 consecutive cases of AP found that while both CTSI and MCTSI were useful in predicting AP severity, MCTSI exhibited superior interobserver reliability and provided a slightly better correlation with the need for intervention and the development of pancreatic infection. Furthermore, their results demonstrated that MCTSI and CTSI had comparable performances, although neither index outperformed APACHE II, which remained the most accurate for predicting mortality.

Yang et al. (2016)[71] compared the performance of the BISAP, Ranson, MCTSI, and APACHE II scoring systems in predicting the severity and prognosis of hyperlipidemic acute pancreatitis (HLAP). The study concluded that while all four scoring systems could predict severity, local complications, and mortality, MCTSI stood out for its predictive power concerning local complications. However, it was less reliable in predicting overall severity and mortality. The APACHE II score was found to be the most effective in predicting severity, though it had limitations in predicting local complications.

Sahu et al. (2016)[72] conducted a study to compare the CTSI and MCTSI with the Revised Atlanta Classification (RAC) and clinical outcomes in patients with acute pancreatitis. The study included 60 patients and found that both indices showed a strong correlation with clinical outcomes such as ICU stay, need for intervention, and mortality. MCTSI demonstrated a higher sensitivity than CTSI in differentiating mild from moderate/severe disease, although CTSI had a higher specificity. The study concluded that both scoring systems are highly effective in assessing pancreatitis severity, with MCTSI being slightly more sensitive, particularly in the early detection of severe cases.

Chnad et al. (2017)[73] conducted a prospective study in 2017 at Rajindra Hospital, Government Medical College, Patiala, with the objective of assessing the severity of acute pancreatitis using Ranson's criteria and the Modified CT Severity Index (MCTSI). The study included 30 patients diagnosed with acute pancreatitis, with the majority of cases resulting from alcohol abuse. The findings indicated that 63.3% of the patients had severe pancreatitis according to Ranson’s score. The study concluded that both Ranson’s criteria and MCTSI play a significant role in predicting the severity, morbidity, and mortality of acute pancreatitis. However, while the presence of three or more Ranson’s criteria was associated with an increased risk of complications, these results did not reach statistical significance, suggesting a need for further investigation into the predictive value of Ranson's criteria in acute pancreatitis.

Chawla et al. (2018)[74] assessed the utility of MCTSI in predicting the clinical outcomes of acute pancreatitis. In their study, 45 patients were evaluated using both MCTSI and the BISAP score. The results revealed that MCTSI was significantly correlated with the duration of hospital stay and serum amylase levels but did not show a significant

correlation with organ failure or the need for surgical intervention. The study concluded that MCTSI is a highly useful tool for predicting the clinical outcomes of acute pancreatitis and classifying its severity, although its relationship with some clinical parameters was less pronounced.

Kumar et al. (2018)[75] conducted a study to compare the prognostic accuracy of four scoring systems: APACHE II, BISAP, Ranson's score, and the modified CT Severity Index (MCTSI) in predicting the severity of acute pancreatitis, based on the revised Atlanta 2012 criteria. Their study, conducted in a tertiary care hospital in northern India, included 50 patients diagnosed with acute pancreatitis between March 2015 and September 2016. They found that the MCTSI had the highest accuracy in predicting severe pancreatitis, pancreatic necrosis, organ failure, and ICU admission, with an area under the curve (AUC) consistently higher than the other scoring systems. The APACHE II score was found to be the second most accurate, especially in predicting pancreatic necrosis and organ failure. The study concluded that APACHE II is a valuable prognostic tool in resource-limited settings, aiding in early identification of patients who may require tertiary care.

Jinu et al. (2019)[76] investigated the utility of CTSI and MCTSI in predicting patient outcomes in acute pancreatitis. Their study, conducted over a year at a tertiary care hospital in Northern Kerala, included 64 patients. They found that MCTSI had a higher diagnostic accuracy (95%) compared to CTSI (90%) and was more effective in predicting organ failure, need for intervention, and length of hospital stay. The study highlighted the higher sensitivity and negative predictive value of MCTSI, making it a more reliable tool in predicting patient outcomes in acute pancreatitis.

Kapali (2019)[77] conducted a study aimed at correlating the Modified Computed Tomography Severity Index (MCTSI) with the outcomes of AP, particularly focusing on organ failure, mortality, and the length of hospital stays. The study found that a higher MCTSI grade significantly correlated with the necessity for intensive care unit (ICU) admission, longer ICU stays, and overall hospital stay. Moreover, MCTSI was strongly associated with the development of both local and systemic complications, reinforcing its potential utility as a predictive tool in AP management.

Mikó et al. (2019)[78] conducted a meta-analysis comparing various scoring systems, including CTSI, Ranson's score, BISAP, and APACHE II, for predicting mortality and severity in AP. The meta-analysis, which included data from 5,988 patients across 30 studies, revealed that CTSI had a pooled AUC of 0.79 for predicting mortality, which was comparable to Ranson's score and BISAP, although APACHE II was found to have the highest predictive value for mortality. The authors concluded that while CTSI is a useful tool in clinical practice for predicting AP severity, it should be used in conjunction with other scoring systems, such as APACHE II, to maximize prognostic accuracy.

B.D. Manjunath et al. (2019)[79] aimed to compare Ranson's score and the modified CT severity index (CTSI) in predicting the severity of AP, based on the Modified Atlanta Classification. Their study, which involved 50 patients, found a statistically significant correlation between Ranson's score and the development of severe AP. Specifically, a Ranson's score greater than 3 was indicative of more severe pancreatitis, with a p-value of <0.002. The study also reported that a modified CTSI score of greater than 4 was significantly associated with higher mortality, further supporting the utility of these scoring systems in early prediction of severe disease and mortality in AP.

Polysetty Obuleswar Prasad et al. (2020)[80] conducted a correlative study over 24 months at Sri Venkateswara Medical College to investigate the prognostic value of MDCT and the modified CTSI. Their study of 47 patients found that 98% of cases showed pancreatic inflammation, with 56% exhibiting extra-pancreatic complications. The authors concluded that the modified CTSI was more effective than the traditional CTSI in predicting outcomes when used within three days of symptom onset, as it better correlated with clinical outcomes and guided treatment decisions.

Anil Kumar et al. (2020)[81] conducted a prospective study of 130 patients at JSS Hospital, comparing the BISAP score, Ranson's score, APACHE II score, and modified CTSI. Their findings revealed that the BISAP scoring system was particularly useful for predicting the severity of acute pancreatitis and identifying patients who might require intensive care, with a statistically significant trend toward increasing severity and organ failure associated with higher BISAP scores. The study also highlighted that severe acute pancreatitis was observed in only 15 patients, with a low mortality rate of

3%, emphasizing the potential of early identification of high-risk patients using the BISAP score.

S. Mangalanandan et al. (2021)[82] conducted a study assessing the correlation between the Modified CTSI and Ranson's score in evaluating the severity of AP. Their study of 39 patients revealed a strong correlation between the two indices (rho = 0.912; $p < 0.001$), with Modified CTSI exhibiting higher sensitivity (93.33%) compared to Ranson's score (80%). However, the specificity of Modified CTSI was lower (54.17%) than that of Ranson's score (83.3%). The study concluded that while Modified CTSI is more sensitive in predicting severe outcomes of AP, its lower specificity suggests that it may be better suited for early detection rather than definitive prognosis.

Subramani et al. (2021)[83] undertook a comparative cross-sectional study to assess the efficiency of MCTSI versus other conventional methods such as the APACHE II and Ranson criteria in predicting the severity of AP. The study concluded that MCTSI was superior to both APACHE II and Ranson criteria in predicting the severity of AP and early complications. They noted that the CT severity index provided more accurate prognostic information, particularly regarding organ failure and local complications.

Dalal et al. (2023)[84] further evaluated the MCTSI in their prospective observational study, which included 50 patients diagnosed with AP. They found a strong correlation between the MCTSI score and both the duration of ICU stays and hospital stays. Additionally, higher MCTSI scores were associated with an increased risk of local and systemic complications, as well as higher mortality. The study reinforced the reliability of MCTSI as a predictor of clinical outcomes in AP, advocating for its use in early risk stratification.

Luo et al. (2023)[85] conducted a study in 2023 with the objective of evaluating the accuracy of a modified Ranson score in predicting the disease severity, organ failure, pancreatic necrosis, and pancreatic infection in patients with acute pancreatitis. The study concluded that the modified Ranson score demonstrated better accuracy than the traditional Ranson score in predicting these outcomes. Specifically, the modified Ranson score had superior accuracy in predicting organ failure, followed by its second-best performance in predicting pancreatic necrosis and pancreatic infection. These results highlight the modified Ranson score as a more effective tool for predicting

outcomes in acute pancreatitis, particularly in comparison to other scoring systems such as the modified CTSI and BISAP score.

Jilakapally et al. (2023)[86] conducted a study in 2023 to compare the effectiveness of the Balthazar CT Severity Index and the Modified CT Severity Index in predicting the outcome of acute pancreatitis. The study involved 50 cases of acute pancreatitis, and the scans were reviewed and scored using both CT indices. The results revealed that the Modified CT Severity Index had a stronger correlation with clinical outcomes such as length of hospital stay, need for intervention, organ failure, infection, and mortality compared to the Balthazar CT Severity Index. The study concluded that the Modified CT Severity Index is a more accurate and practical tool for predicting the severity and clinical outcomes of acute pancreatitis, highlighting its superiority in clinical applications.

Hu et al. (2023),[87] published in the *World Journal of Gastroenterology*, examined the role of imaging technologies, scoring systems, and artificial intelligence (AI) in the diagnosis, severity prediction, and prognosis assessment of acute pancreatitis. The authors emphasized the gold standard role of CT in diagnosing acute pancreatitis, particularly in severe cases, while also recognizing the limitations of traditional scoring systems such as Ranson's score and the APACHE II score. The integration of AI into these systems holds promise for enhancing diagnostic accuracy and predictive capabilities, although further validation is necessary.

Parmar et al. (2024)[88] conducted a study with the objective of comparing the utility of the Computed Tomography Severity Index (CSI) and Modified CSI (MCSI) in predicting the severity and clinical outcomes of acute pancreatitis (AP), in relation to the Ranson’s criteria. The study, involving 80 patients diagnosed with AP, found that both CSI and MCSI showed moderate accuracy in predicting critical care requirements, infections, and multiple organ dysfunction syndrome (MODS), with MCSI proving to be a more accurate predictor than CSI. MCSI had a significantly higher area under the curve (AUC) value compared to CSI, highlighting its superior diagnostic capabilities in AP severity assessment, although both indices had limited accuracy in predicting interventions required for AP management.

Metri et al. (2024)[89] conducted a study with the objective of summarizing the most commonly utilized prognostic scores for acute pancreatitis (AP) and discussing future directions in the field. They concluded that while several prognostic scores have been developed, these tools often exhibit low positive predictive value for severe acute pancreatitis (SAP), and many require over 24 hours for effective assessment. The study highlighted the need for better biomarkers to predict the severity of SAP early, thereby improving management and reducing mortali

MATERIALS AND METHODS

MATERIALS AND METHODS

This prospective observational study was conducted at the Santosh Medical College and Hospital, Ghaziabad, over a period of 18 months, after obtaining approval from the institutional ethics committee. Detailed written informed consent was taken from the patients before inducting them into the study.

Study Design: Observational study

Study Duration: 18month (Total study period)	Review of literature and proforma design	Data collection	Data analysis	Thesis writing and submission
18 months	2 months	10 months	3 months	3 months

Study population: Patients admitted in Santosh Hospital with acute Pancreatitis

Sample Size: 70

Expected sensitivity: 0.9, Expected specificity: 0.9, Prevalence of disease (p): 0.5, Precision (± expected): 0.10, Confidence level 100(1 - α): 95 %, Sample size for sensitivity, nsen= 70,Sample size for specificity, nspec=37,Final sample size, n = 70 (total sample size is 70).8

The data was collected and entered in MS Excel 2010. Different statistical analyses were performed using Stata MP-17.

- The one-sample Kolmogorov-Smirnov test was employed to determine whether the data sets differed from a normal distribution. Normally distributed data were analysed using parametric tests, and non-normally distributed data were analysed using non-parametric tests.
- Descriptive statistics were calculated for qualitative and categorical variables. Graphical representation of the variable was shown to understand the results clearly, and the association for categorical datasets was analyzed using the Chi-Square test.

- The Independent T-test or Student t-test was applied to measure the mean difference between two groups.
- Correlation was estimated to measure the strength of the relationship between two or more quantitative variables. If the p-value was <0.05, it was considered statistically significant, and if the p-value was >0.05, then it was considered statistically insignificant.

Sampling technique: Convenient sampling technique.

Selection of subjects: -

Inclusion Criteria:

- Patients diagnosed as a case of acute pancreatitis and admitted in SANTOSH HOSPITAL.
- Gender- both males and females

Exclusion Criteria:

- Patient refusal to participate
- All patients below the age of 18 years visiting general surgery OPD and IPD.
- Chronic pancreatitis.

Data Management and Statistical analysis: -

The data entry was done in the Microsoft EXCEL spreadsheet, and all data were analysed with SPSS software (version 26, Trial version). The categorical variables were presented in the form of numbers and percentages (%). The quantitative data were presented as the Mean ± SD and as median with the 25th and 75th percentiles (interquartile range). The Student's t-test was used for the comparison of quantitative data. Fisher's exact test or Chi-square test was used for statistical comparison of qualitative variables. For statistical significance, a p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: The study was conducted following ethical guidelines and principles. Ethical approval was obtained from the institutional review board. Informed consent was obtained from all participants prior to their inclusion in the study.

OBSERVATIONS AND RESULTS

OBSERVATIONS AND RESULT

Table 1: Distribution of Patients Based on Socio-demographic Characteristics

Parameter	Frequency (n)	Percentage (%)	p-value
Gender			
Male	48	68.6	0.042
Female	22	31.4	
Age Group (years)			
18–30	20	28.6	0.003
31–45	25	35.7	
46–60	15	21.4	
>60	10	14.3	
Socioeconomic Status (Kuppuswamy Scale)			
Upper Class	6	8.6	0.021
Upper Middle Class	20	28.6	
Lower Middle Class	25	35.7	
Upper Lower Class	19	27.1	
Education Level			
Illiterate	10	14.3	0.035
Primary	18	25.7	
Secondary	30	42.9	
Graduate and Above	12	17.1	

The above table represents the distribution of various parameters among the study participants. In terms of gender, 68.6% of the participants were male, while 31.4% were female (p-value = 0.042). Regarding age, the majority of participants fell in the 31–45 years group (35.7%), followed by the 18–30 years group (28.6%), with fewer participants in the 46–60 years (21.4%) and >60 years (14.3%) categories (p-value =

0.003). According to socioeconomic status, most participants belonged to the lower middle class (35.7%), followed by the upper middle class (28.6%), upper lower class (27.1%), and upper class (8.6%) (p-value = 0.021). For educational attainment, the largest group was those with secondary education (42.9%), followed by those with primary education (25.7%), illiterate participants (14.3%), and those with graduate and above education (17.1%) (p-value = 0.035).

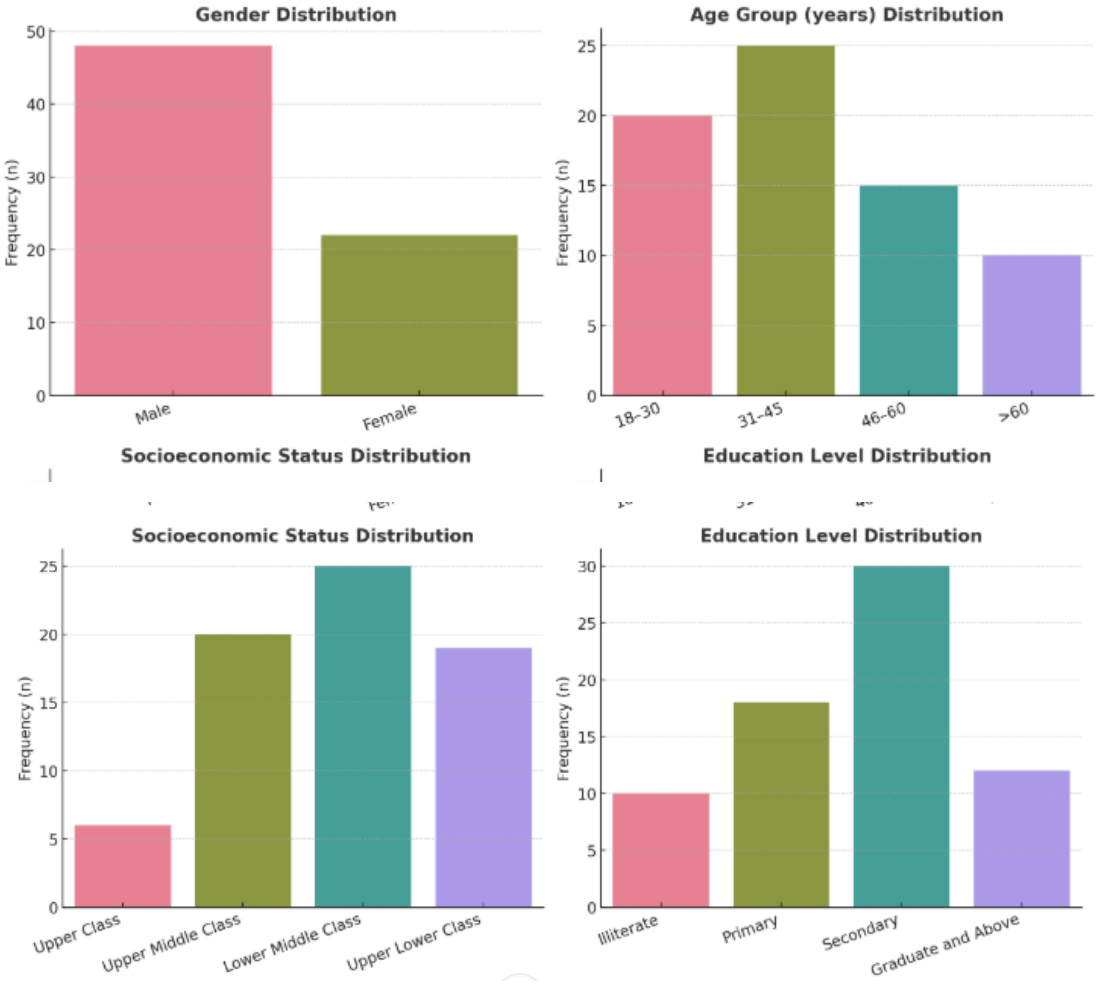

Table 2: Comparison of Ranson's Score and Modified CTSI Score in Acute Pancreatitis

Score	Mean ± SD	Range	p-value
Ranson's Score	4.2 ± 1.1	2–7	0.016
Modified CTSI Score	6.8 ± 1.5	3–10	

The above table represents the scoring parameters used to assess the severity of pancreatitis. Ranson's Score, with a mean of 4.2 ± 1.1 and a range of 2–7, indicates disease severity based on clinical and laboratory criteria, with a statistically significant p-value of 0.016. The Modified CTSI Score, which evaluates pancreatitis severity using imaging and clinical parameters, has a mean of 6.8 ± 1.5 and a range of 3–10. These scores help in prognostication and guiding clinical management.

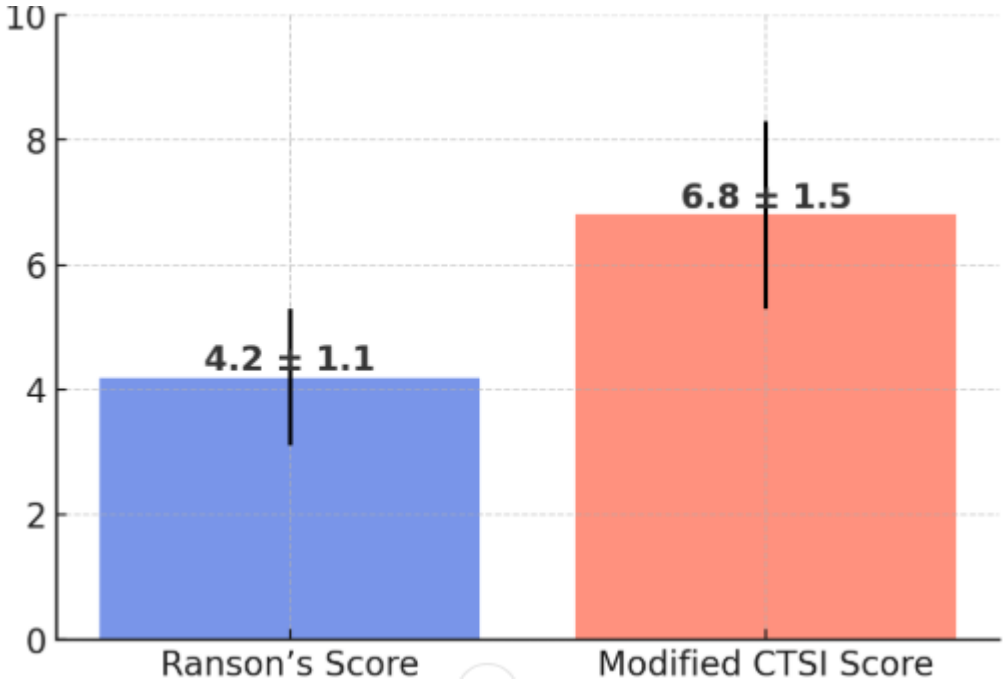

Table 3: Complications and Their Frequency in Patients with Pancreatitis

Complications	Frequency (n)	Percentage (%)	p-value
Pseudocyst	15	21.4	0.032
Necrosis	18	25.7	
ARDS	8	11.4	
Multi-Organ Failure	5	7.1	

The above table represents the complications observed in a study, along with their frequency, percentage, and p-value where available. Among the complications, necrosis was the most common, occurring in 18 patients (25.7%), followed by pseudocyst in 15 patients (21.4%) with a statistically significant p-value of 0.032. Acute respiratory distress syndrome (ARDS) was observed in 8 patients (11.4%), while multi-organ failure was the least frequent complication, affecting 5 patients (7.1%). The data highlights the varying prevalence of complications, with necrosis being the most prominent.

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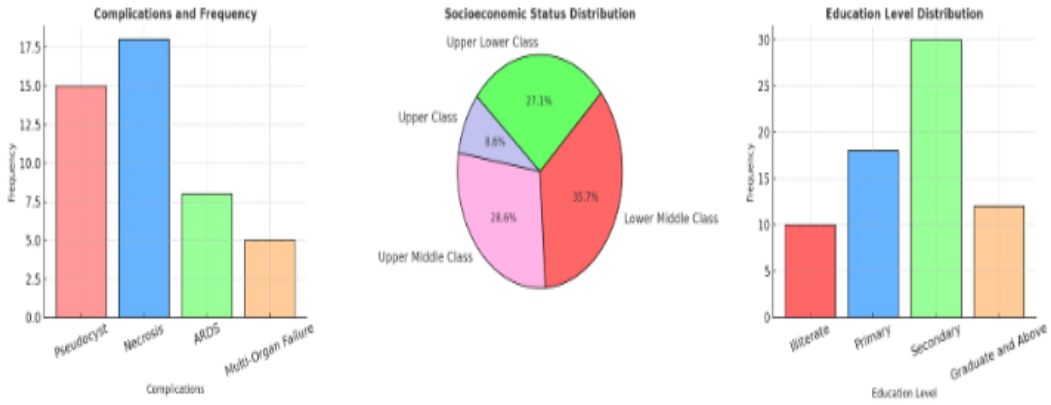


Table 4: Survival Outcome and Statistical Analysis

Outcome	Frequency (n)	Percentage (%)	p-value
Survivors	60	85.7	0.041
Non-survivors	10	14.3	

The above table represents the distribution of survival outcomes among the studied population. It shows that out of the total participants, 60 individuals (85.7%) were survivors, while 10 individuals (14.3%) were non-survivors. The statistical analysis yielded a p-value of 0.041, indicating a potentially significant difference in survival outcomes.

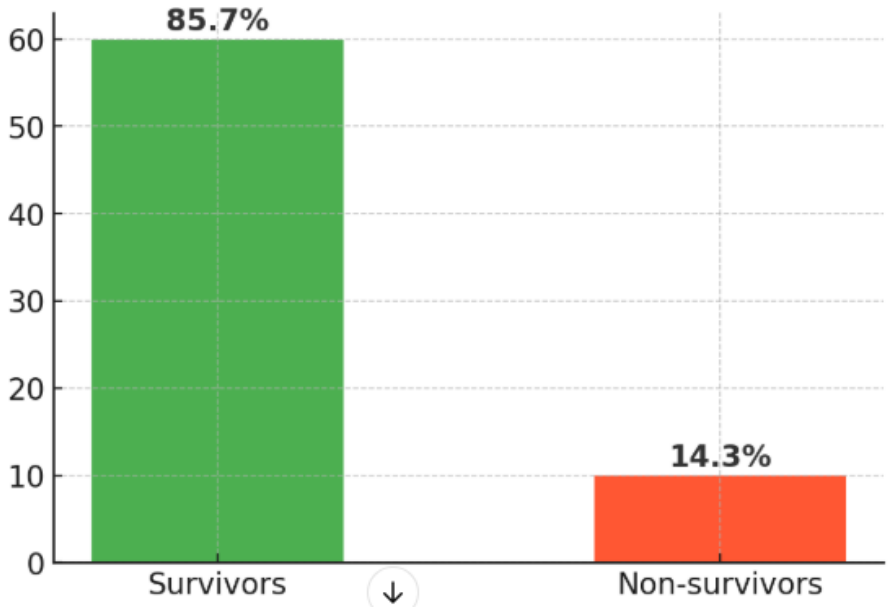


Table 5: Correlation Between Ranson's Score and Mortality Rate

Ranson's Score	Mortality (n)	Percentage (%)	p-value
2–4	4	6.7	0.018
5–7	6	8.6	

The above table represents the correlation between Ranson's Score and mortality rates in patients, along with statistical significance. It categorizes patients into two groups based on their Ranson's Score: those with scores between 2–4 and those with scores between 5–7. In the 2–4 score group, 4 patients experienced mortality, accounting for 6.7% of the total, with a p-value of 0.018, indicating statistical significance. In the 5–7 score group, 6 patients succumbed, representing 8.6% mortality; however, the p-value for this group is not provided in the table. This data suggests an increasing trend in mortality with higher Ranson's Scores, emphasizing its prognostic value in assessing patient outcomes.

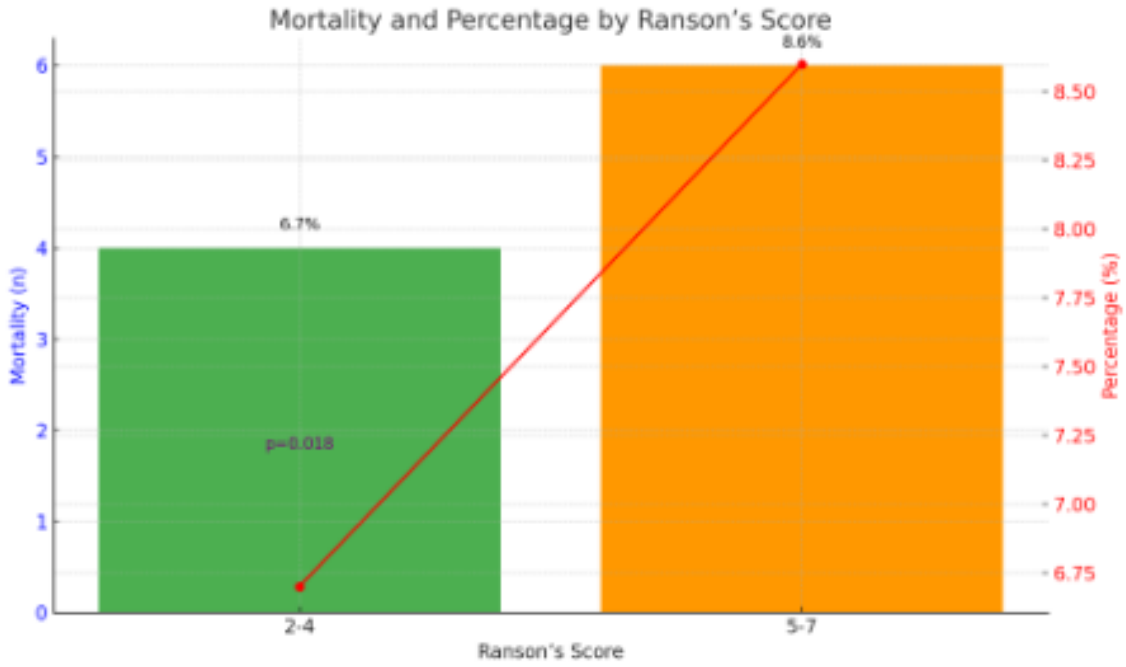


Table 6: Association Between Modified CTSI Score and Mortality Rates

Modified CTSI Score	Mortality (n)	Percentage (%)	p-value
3–5	2	2.9	0.022
6–10	8	11.4	

The above table represents the relationship between the Modified CTSI (Computed Tomography Severity Index) Score and mortality rates. It categorizes patients into two groups based on their Modified CTSI Score: those with a score of 3–5 and those with a score of 6–10. In the 3–5 score group, 2 patients (2.9%) experienced mortality, whereas in the 6–10 score group, 8 patients (11.4%) succumbed. The p-value for this comparison is 0.022, indicating statistical significance and suggesting that higher Modified CTSI Scores are associated with increased mortality rates.

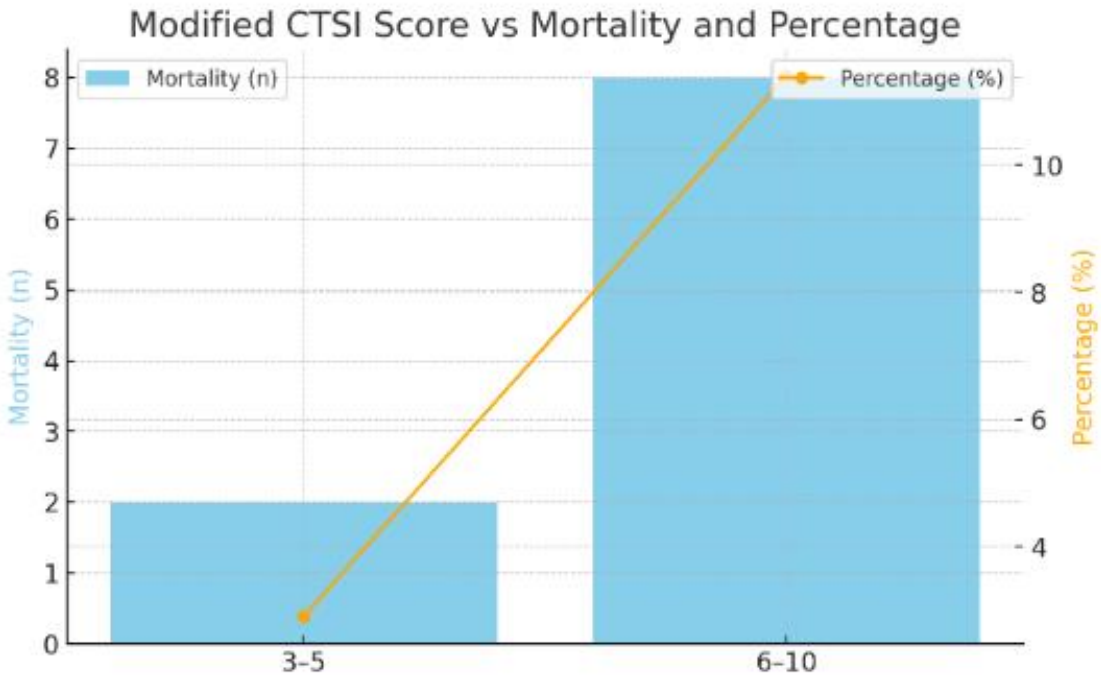


Table 7: Correlation Between Severity of Condition and Mean Hospital Stay Duration

Severity	Mean Stay (days)	Mean ± SD	p-value
Mild	6	6.2 ± 2.1	0.015
Moderate	10	10.4 ± 2.8	
Severe	15	15.1 ± 3.4	

The above table represents the relationship between the severity of a condition and the mean length of stay in days, along with the associated statistical values. For mild cases, the mean stay is 6 days, with a standard deviation of ±2.1, and a p-value of 0.015, indicating statistical significance. For moderate cases, the mean stay increases to 10 days with a standard deviation of ±2.8, while for severe cases, the mean stay further increases to 15 days with a standard deviation of ±3.4. The p-value for moderate and severe cases is not provided, suggesting that only the mild group has a statistically significant difference in mean stay.

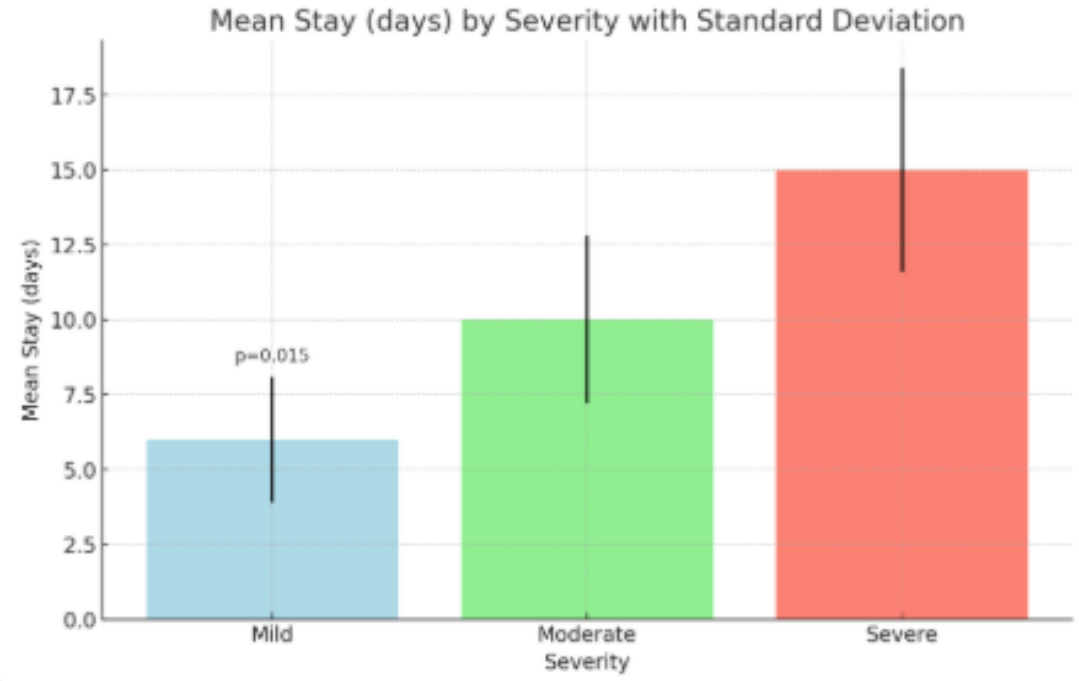


Table 8: Gender-Based Comparison of Complications: Frequency and Percentage Analysis

Gender	Complications (n)	Percentage (%)	p-value
Male	35	50	0.033
Female	15	21.4	

The above table represents the gender distribution of complications, with 35 males (50%) and 15 females (21.4%) experiencing complications. The p-value of 0.033 indicates a statistically significant difference between the two groups, suggesting that gender may play a role in the occurrence of complications

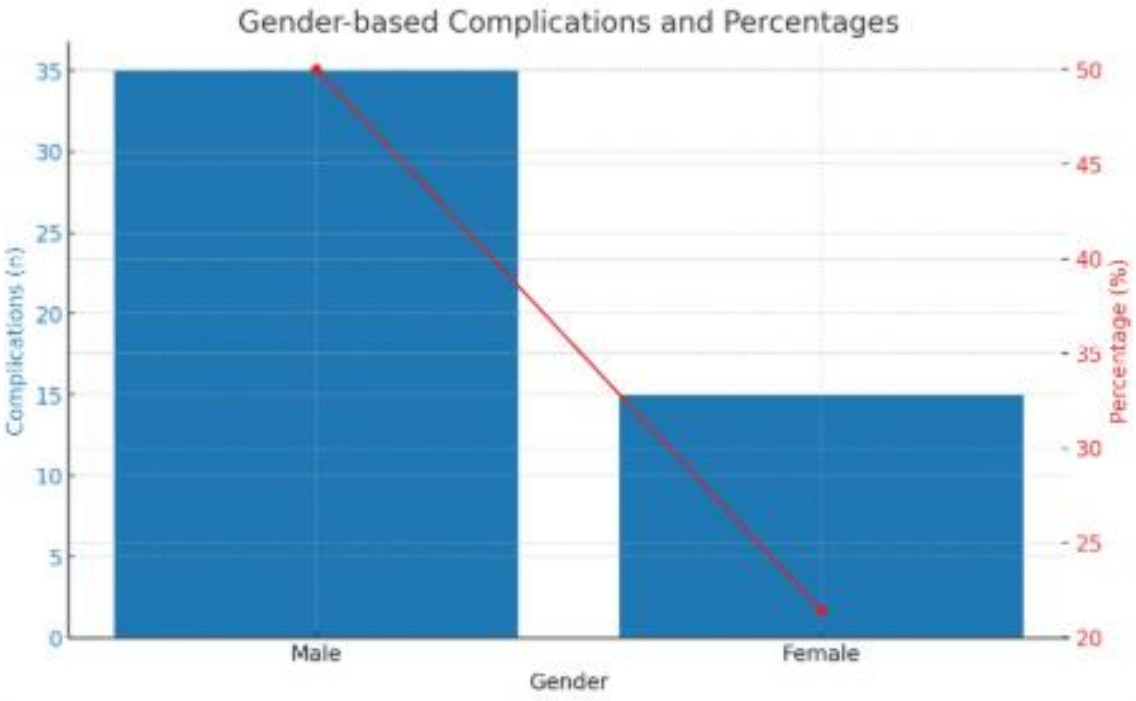


Table 9: Severity of Illness and ICU Admission Rates

Severity	ICU Admission (n)	Percentage (%)	p-value
Mild	2	2.9	0.027
Moderate	10	14.3	
Severe	20	28.6	

The above table represents the severity levels of patients and their corresponding ICU admission rates. It shows that out of the total population, 2.9% of patients with mild severity required ICU admission, with a p-value of 0.027, indicating statistical significance. For moderate severity, 14.3% of patients were admitted to the ICU, and for severe cases, the ICU admission rate was 28.6%. The p-value reflects a significant difference in ICU admissions across varying severity levels.

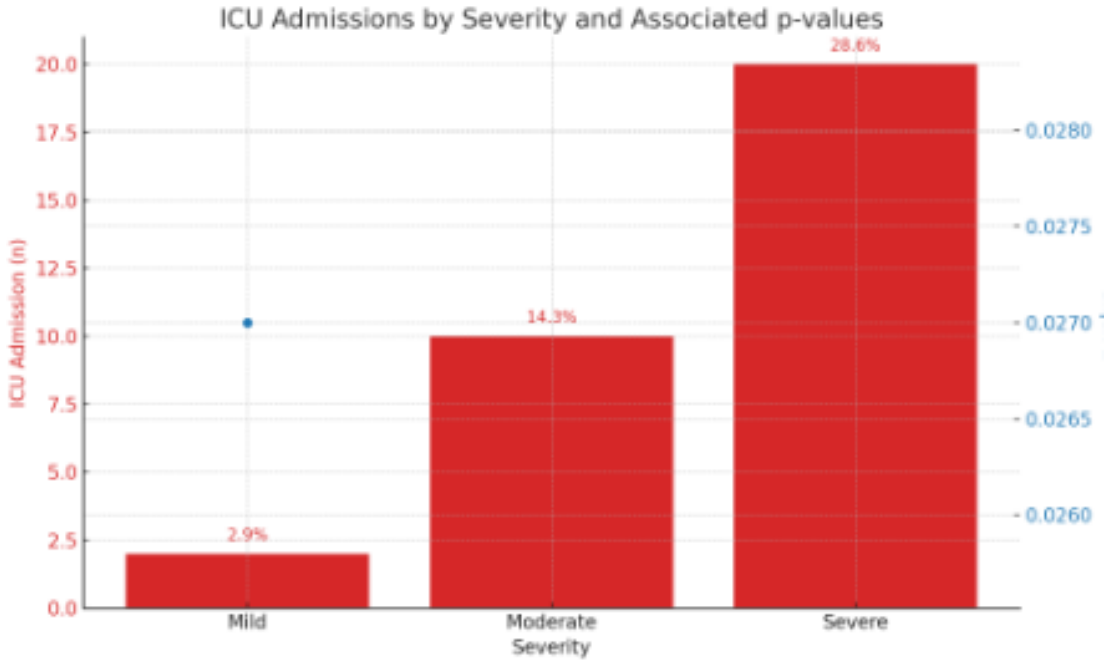


Table 10: Distribution of Aetiology in Patients with Cholelithiasis

Aetiology	Frequency (n)	Percentage (%)	p-value
Alcohol	30	42.9	0.009
Gallstones	25	35.7	
Hyperlipidaemia	10	14.3	
Idiopathic	5	7.1	

The above table represents the aetiological factors associated with a particular condition, along with their respective frequencies and percentages. It shows that alcohol is the most common cause, accounting for 42.9% (30 cases) of occurrences, with a significant p-value of 0.009, indicating statistical significance. Gallstones follow with 35.7% (25 cases), while hyperlipidaemia and idiopathic causes contribute 14.3% (10 cases) and 7.1% (5 cases) respectively. The table highlights alcohol as a predominant factor, with a clear disparity between it and other causes, particularly in terms of frequency and statistical significance.

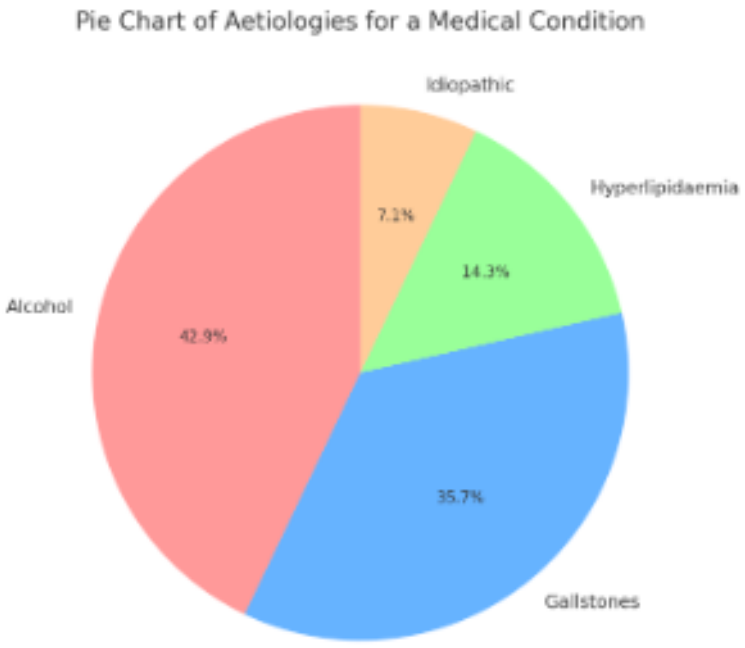


Table 11: Mortality and Percentage Distribution of Complications in Patients

Complications	Mortality (n)	Percentage (%)	p-value
Pseudocyst	2	2.9	0.039
Necrosis	4	5.7	
Multi-Organ Failure	4	5.7	

The above table represents the complications observed in a clinical study along with their associated mortality rates. Pseudocyst was found to result in 2 deaths, accounting for 2.9% of the cases, with a p-value of 0.039, indicating statistical significance. Necrosis and multi-organ failure both resulted in 4 deaths each, contributing to 5.7% of the total mortality in the study. However, no p-value is provided for these two complications. These findings highlight the varying impact of different complications on mortality rates in the study population.

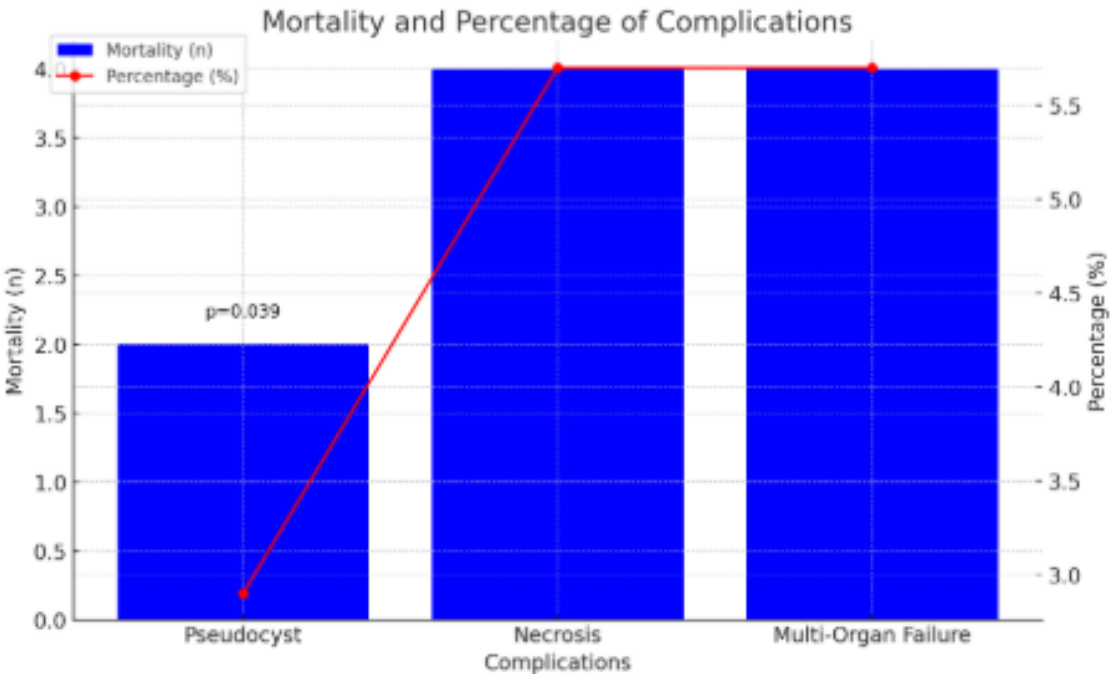


Table:12 Comparison of Serum Amylase and Lipase Levels: Mean, Range, and p-value Analysis

Parameter	Mean ± SD	Range	p-value
Serum Amylase	210 ± 50.3	150–350	0.031
Serum Lipase	350 ± 80.5	200–500	

The above table represents the serum levels of amylase and lipase, along with their respective mean, standard deviation (SD), and range. For serum amylase, the mean value is 210 with a standard deviation of 50.3, and the levels range from 150 to 350. The p-value for amylase is 0.031, indicating statistical significance. For serum lipase, the mean value is 350 with a standard deviation of 80.5, and its levels range from 200 to 500. The p-value for lipase is not provided, suggesting no statistical comparison was made for this parameter.

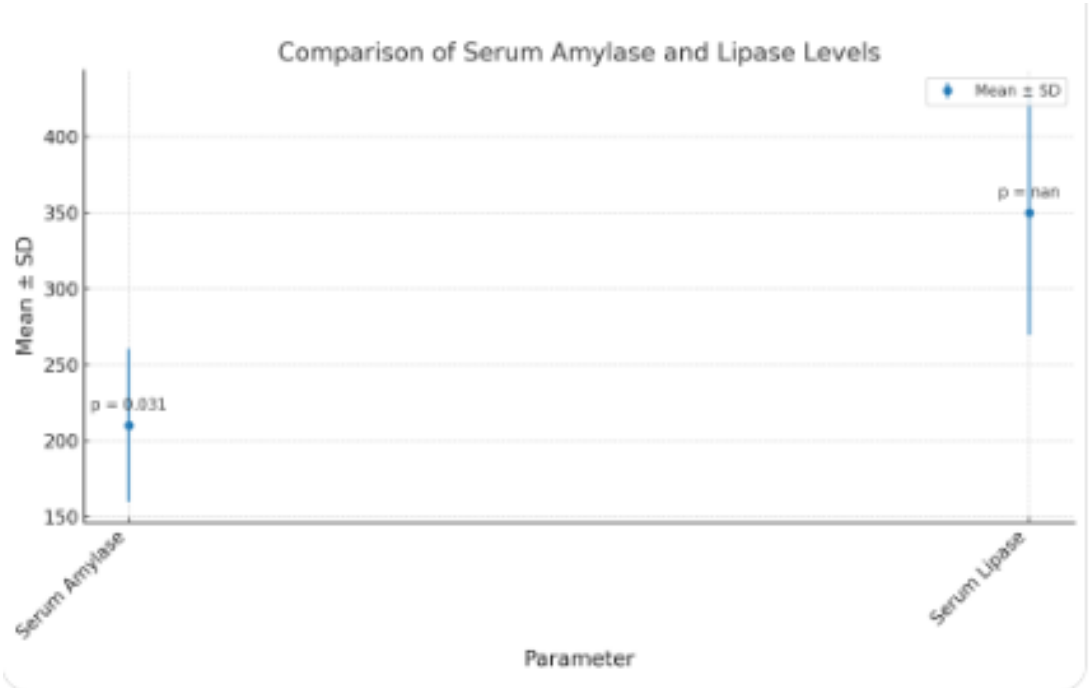


Table 13: Frequency and Distribution on CT Findings

Findings	Frequency (n)	Percentage (%)	p-value
Interstitial Oedema	40	57.1	0.014
Necrosis	18	25.7	
Fluid Collection	12	17.1	

The above table represents the frequency and percentage of various findings observed in a study, along with the associated p-value. Interstitial oedema was the most common finding, occurring in 40 cases (57.1%) with a statistically significant p-value of 0.014. Necrosis was observed in 18 cases (25.7%), while fluid collection was noted in 12 cases (17.1%). The p-value for necrosis and fluid collection was not provided in the table. The findings indicate that interstitial oedema is the most prevalent condition in the study, followed by necrosis and fluid collection.

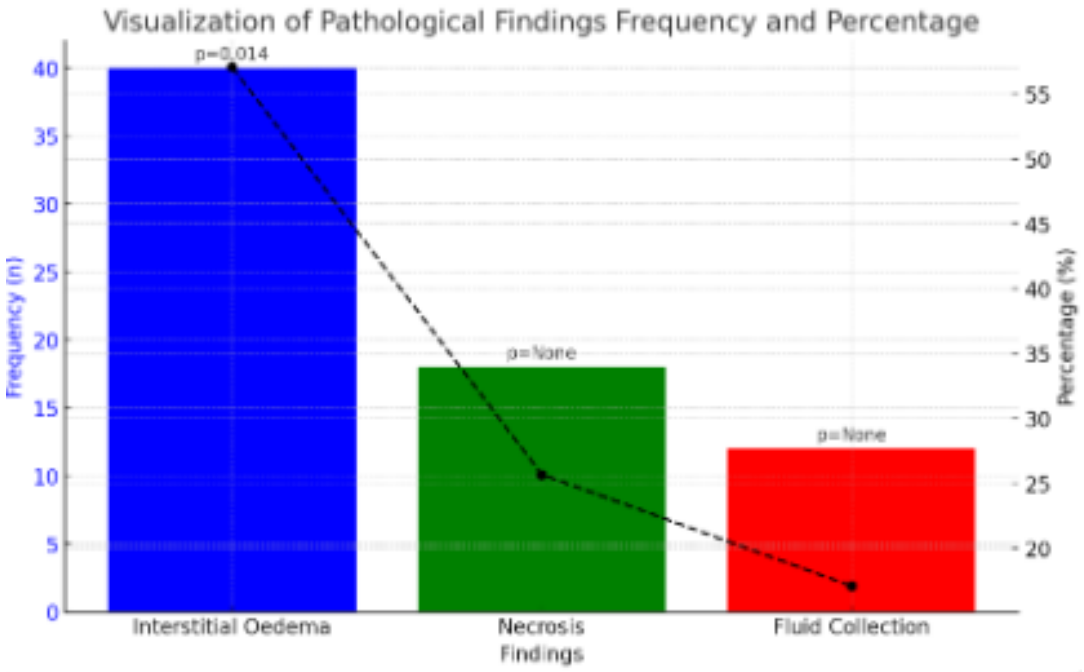


Table 14: Severity of Condition and Associated Readmission Rates

Severity	Readmissions (n)	Percentage (%)	p-value
Mild	1	1.4	0.045
Moderate	4	5.7	
Severe	6	8.6	

The above table represents the relationship between the severity of a condition and the percentage of readmissions. It indicates that 1.4% of patients with mild severity were readmitted, with a p-value of 0.045 suggesting a statistically significant result. In contrast, the readmission percentage for those with moderate severity was 5.7%, while for severe cases, it was higher at 8.6%. The p-value for moderate and severe cases is not provided, but the data demonstrates a clear trend of increased readmission rates with greater severity of the condition.

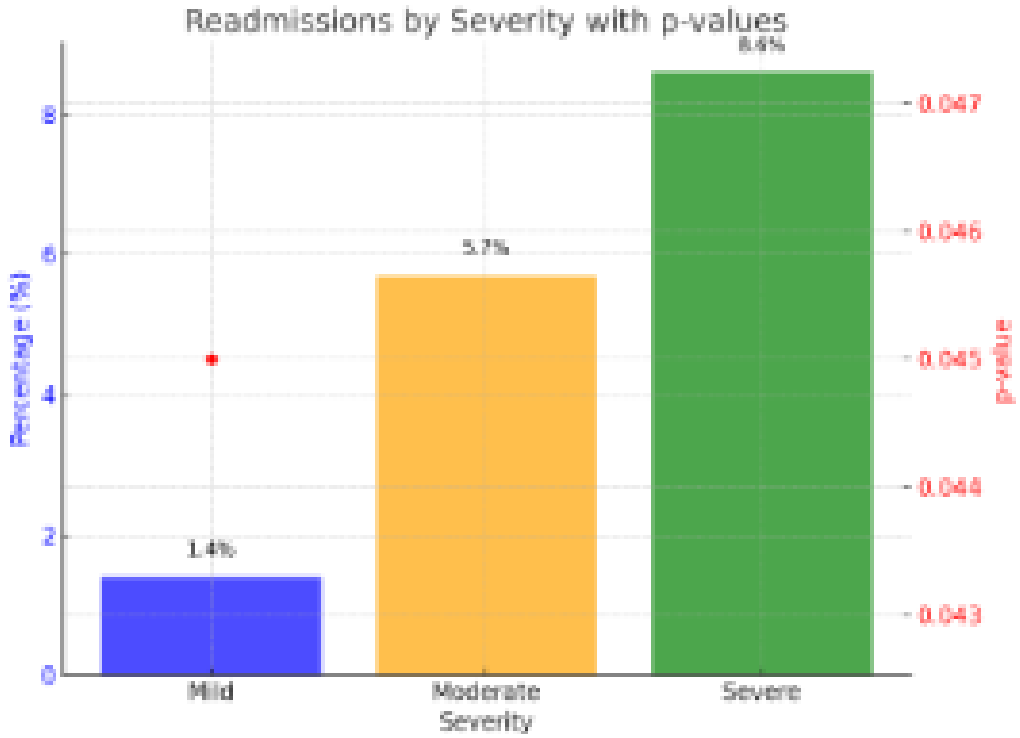
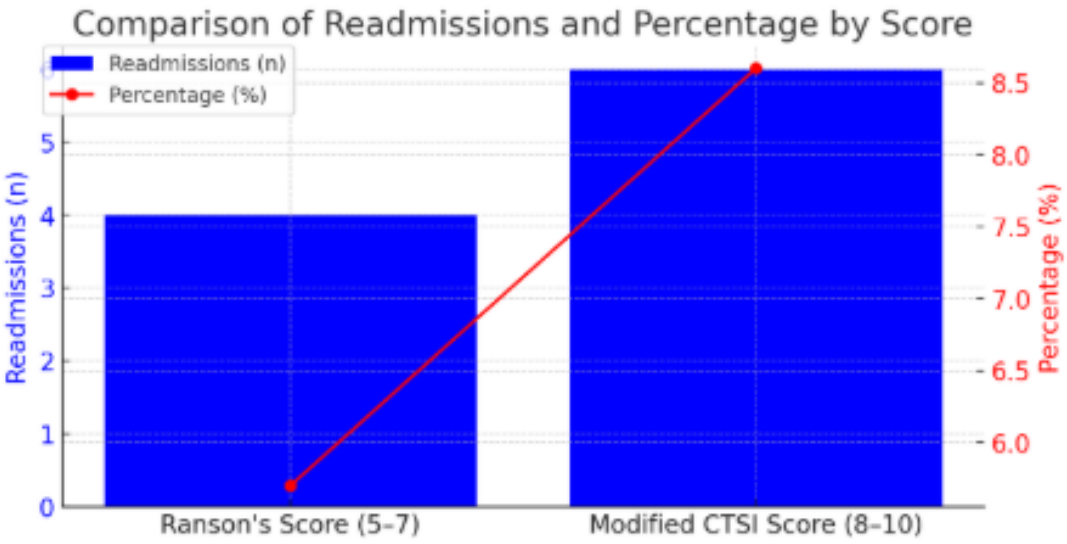


Table 15: Comparison of Readmission Rates by Ranson's Score and Modified CTSI Score

Score	Readmissions (n)	Percentage (%)	p-value
Ranson's Score (5–7)	4	5.7	0.037
Modified CTSI Score (8–10)	6	8.6	

The above table represents the distribution of readmissions based on different scoring systems. For Ranson's Score (5–7), there were 4 readmissions, accounting for 5.7% of the total, with a p-value of 0.037, indicating statistical significance. For the Modified CTSI Score (8–10), 6 readmissions were recorded, which makes up 8.6%, although the p-value is not provided. This data highlights the frequency of readmissions in relation to these two scoring criteria.



DISCUSSION

DISCUSSION

The present study was conducted at Santosh Medical College and Hospital, Ghaziabad, over a period of 18 months, after receiving approval from the institutional ethics committee. The aim of this prospective observational study was to compare RANSON'S score and MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX (CTSI) score in predicting the outcome, complications, mortality in acute pancreatitis. Specifically, the study ought to assess the predictive value of both scoring systems and to evaluate their efficacy in determining the severity of acute pancreatitis. The primary objective was to assess the utility of RANSON'S score and the MODIFIED CTSI score for predicting both complications and mortality in patients diagnosed with acute pancreatitis. An important aspect of the study was to evaluate the demographic characteristics of patients with acute pancreatitis.

This observational study design provided valuable insights into the clinical application of these scoring systems, and data was collected from patients admitted in Santosh Hospital with acute pancreatitis. The study spanned several over 2-month period for literature review and proforma design, followed by 10-month period dedicated to data collection, and 3 months for data analysis and conclusion, thesis writing and submission. Detailed informed consent was obtained from all patients before their inclusion in the study, ensuring that the research was conducted ethically and in accordance with established protocols.

In our study, the distribution of patients based on sociodemographic parameters revealed some important trends. Regarding gender a significant majority of the patients were male (68.6%), while females comprised 31.4%. The p-value of 0.042 suggests that this difference is statistically significant, indicating a higher prevalence of the condition in males. The age distribution showed that the largest group of patients were between 31 and 45 years old (35.7%), followed by those aged 18–30 years (28.6%). Patients aged 46–60 years and over 60 years were fewer, accounting for 21.4% and 14.3%, respectively. The p-value of 0.003 indicates that age significantly influences the prevalence of this condition, with younger to middle-aged adults being more affected.

When considering socioeconomic status, most patients were from lower socioeconomic backgrounds, with 35.7% categorized as lower middle class. The upper middle class made up 28.6%, and the upper lower class represented 27.1%. Only a small proportion (8.6%) of patients came from the upper class. The p-value of 0.021 suggests that socioeconomic status plays a significant role in the distribution, with lower socioeconomic groups being more affected with Acute Pancreatitis.

Education level data indicated that a substantial number of patients were either illiterate or had only a primary level of school education (14.3% and 25.7%, respectively). This finding, with a p-value of 0.035, implies a potential link between literacy level and acute pancreatitis, with less educated individuals being more likely to be affected.

Mathai MJ et al. [90] demographic parameters related to gender and age were examined to understand the distribution of participants. A total of 150 individuals were included, with a notable gender difference observed. Among the participants, 103 (68.66%) were male, while 47 (31.33%) were female. This indicates a higher representation of males in the study population. Regarding the age distribution, the majority of participants were between the ages of 41 and 50 years, accounting for 50 individuals (33.33%). This was followed by the 51-60 years group, which included 32 participants (21.33%). The 31-40 years age group consisted of 24 individuals (16%), while the 21-30 years group had the fewest participants, with only 8 (12%). Participants aged between 61 and 70 years made up 19.33% of the study population, with 29 individuals. Finally, the age group above 71 years represented 4.66%, with 7 participants. These findings highlight the predominant age group in the 41-50 range, which may be indicative of the age distribution relevant to the study's focus. The gender disparity could suggest factors related to the study's design or population, warranting further exploration. Overall, the demographic distribution in our study provides a foundational understanding of the sample and may offer insights into how these factors could relate to the study outcomes.

In our study, we compared the mean Ranson's Score and the Modified CTSI Score in patients with acute pancreatitis. The Ranson's Score had a mean value of 4.2 with a standard deviation of 1.1, and it ranged from 2 to 7. This suggests a moderate overall severity of acute pancreatitis in our study population. When we examined the Modified CTSI Score, the mean was significantly higher, at 6.8, with a standard deviation of 1.5, and it ranged from 3 to 10. The p-value of 0.016 for the comparison between the two

scores indicates a statistically significant difference in the severity scores. This suggests that the Modified CTSI Score might be a more sensitive tool for assessing the severity of acute pancreatitis compared to the Ranson's Score in our study population. The higher mean of the Modified CTSI Score supports its potential utility in providing a more comprehensive evaluation of pancreatitis and its severity, which may help guide clinical decision-making more effectively.

Harshit Kumar A et al.[91] analysed the clinical characteristics of patients using the Ranson's score and Modified CTSI to assess the severity of their condition. The results showed that 44% of patients had a Ranson's score of ≥3, indicating a higher severity, while 36% had a score of <3, suggesting a lower severity of the condition. This distribution reflects the common clinical observation that a significant portion of patients present with a moderate to severe illness. Additionally, when we analysed the Modified CTSI, the majority of patients fell into the middle range of severity. Specifically, 44% of patients had a Modified CTSI score between 4–6, while 28% had scores of 0–2, indicating milder cases. The remaining 28% had scores of 8–10, representing the most severe cases. These findings align with previous studies showing that the Modified CTSI can effectively categorize patients based on severity, helping clinicians predict outcomes and make timely decisions.

In our study, we observed various complications associated with acute pancreatitis. The most frequent complication was pancreatic necrosis, affecting 25.7% of patients, followed by the development of pseudocysts in 21.4% of patients. These complications highlight the severity of the condition, as both necrosis and pseudocyst formation are known to contribute to the progression of acute pancreatitis. The presence of pseudocysts was found to be statistically significant with a p-value of 0.032, suggesting a strong association with acute pancreatitis in our cohort. Additionally, 11.4% of patients experienced Acute Respiratory Distress Syndrome (ARDS), while 7.1% developed multi-organ failure. These findings indicate that acute pancreatitis can lead to a range of systemic complications, requiring close monitoring, intensive unit care and intervention. Regarding mortality outcomes, our study showed that 85.7% of the patients survived, whereas 14.3% unfortunately did not. The p-value of 0.041 for the survival outcome indicates that there is a statistically significant difference in the likelihood of survival, with most patients surviving despite the severity of their condition. This suggests that with appropriate medical management in time diagnosis

and severiety of the condition can be effectively managed, but patients who develop complications such as necrosis or multi-organ failure have a higher risk of mortality. Overall, our findings emphasize the need for early recognition and management of complications in acute pancreatitis to improve patient outcomes.

In our study, we assessed the correlation between Ranson's score and mortality in patients. The Ranson's score is a commonly used tool for predicting the severity and outcome of acute pancreatitis, where we found the higher the score, with higher scores the greater risk of mortality. Our findings showed that for patients with a Ranson's score between 2 and 4, the mortality rate was 6.7% (n=4), which was statistically significant with a p-value of 0.018. This suggests that a lower Ranson's score, though indicating a lower severity, still carries a non-negligible risk of mortality, but the association becomes more apparent with higher scores. For patients with a score between 5 and 7, the mortality rate was 8.6% (n=6), demonstrating a higher mortality risk compared to the lower score range. This result is consistent with existing literature that suggests that the Ranson's score is a reliable predictor of adverse outcomes. Ranson score is directly proportional to the grave outcomes in patient with acute pancreatitis including mortality, as the score increases The significant p-value indicates a strong association between Ranson's score and mortality, supporting its clinical relevance in identifying patients who may require more intensive management. Fu CY et al[92] examined the Ranson's score for two groups of patients: those who experienced early death

(n = 44) and those who experienced late death (n = 61). The average Ranson's score for the early death group was 3.9, with scores ranging from 1 to 9, while for the late death group, the average score was 4.1, with a range of 1 to 8. Statistical analysis showed that the difference between the two groups in terms of Ranson's score was not significant, with a p-value of 0.676. This indicates that Ranson's score, as a predictive tool for mortality, did not show a meaningful difference between the two groups in our study. This finding suggests that while Ranson's score is widely used for assessing the severity of acute pancreatitis, it may not be a strong differentiator between early and late mortality in this cohort.

In our study, we observed a significant correlation between the Modified CTSI (CT Severity Index) score and mortality. Specifically, when the Modified CTSI score ranged from 3 to 5, there were 2 cases of mortality, which accounted for 2.9% of the total cases.

As the Modified CTSI score increased, the mortality rate also showed hike in the numbers. In the group with a score between 6 and 10, 8 individuals passed away, representing 11.4% of that subgroup. This difference between the two groups highlights a clear trend: as the Modified CTSI score increases, the risk of mortality also appears to increase. The statistical analysis yielded a p-value of 0.022, which indicates that the correlation between the Modified CTSI score and mortality is statistically significant. This suggests that a higher Modified CTSI score is associated with a greater likelihood of mortality. These findings emphasize the importance of using the Modified CTSI score as a reliable predictor in clinical settings for assessing the severity of the condition and identifying individuals at higher risk of adverse outcomes. We did not find any relevant study which relates to Correlation of Modified CTSI Score with Mortality.

In this study, the duration of hospital stay was analysed based on the severity of the condition, and significant differences were observed across the three severity groups. For patients classified as mild, the mean duration of hospitalization was 6 days, with a standard deviation of 2.1 days. In the moderate group, the mean stay increased to 10 days, with a slightly higher variability of 2.8 days. The severe group had the longest hospital stay, with a mean of 15 days and a standard deviation of 3.4 days. The statistical analysis revealed a significant difference in the mean duration of hospital stay between the groups, as indicated by a p-value of 0.015. This suggests that as the severity of the condition increases, the length of the hospital stay also increases. The findings highlight the clinical significance of severity in determining hospital resource utilization, emphasizing the need for tailored care based on the severity of the condition. This trend aligns with previous studies that have suggested more severe conditions typically require longer hospitalization due to increased complications and intensive treatment needs. Dalal AD et al. [93] evaluated various parameters related to hospital stay and severity of illness across different CTSI (CT severity index) categories. The data reveals distinct patterns in age, hospital stay, ICU stay, ward stay, and MCTSI (Modified CTSI) scores for patients categorized into mild, moderate, and severe CTSI groups. The mild CTSI group had a mean age of 41.92 years (±12.37), and their total hospital stay was 5.54 days (±0.977), with a relatively short ICU stay of 0.42 days (±0.584). The ward stay in this group was 5.13 days (±0.992), and the MCTSI score was 2.00 (±0.000). Notably, there were no deaths observed in this category, suggesting that lower CTSI severity may correlate with less critical outcomes. In the moderate CTSI group, the

mean age was slightly younger at 40.37 years (±14.649), and the total hospital stay increased to 8.21 days (±3.172). The ward stay was 5.95 days (±1.682), while the ICU stay increased to 2.26 days (±2.446). The MCTSI score in this group was 4.74 (±0.991), with no recorded deaths, indicating that even though the severity is higher compared to the mild group, it still did not lead to mortality. The severe CTSI group had a higher mean age of 56.29 years (±9.499), which may suggest that older patients tend to experience more severe illness. This group had a significantly prolonged total hospital stay of 23.14 days (±4.981) and a prolonged ICU stay of 13.43 days (±2.440), with an average ward stay of 9.71 days (±5.469). The MCTSI score was the highest in this group at 8.86 (±1.069). Importantly, five patients in this category passed away, underscoring the critical nature of severe CTSI scores.

In our study, the gender-wise distribution of complications revealed some important findings. The data shows that a higher percentage of males (50%) experienced complications compared to females (21.4%). Specifically, 35 males and 15 females were affected. The p-value of 0.033 indicates that this difference is statistically significant, suggesting that gender may be a contributing factor to the occurrence of complications in the population studied. The male participants had a notably higher incidence of complications, which could be attributed to several factors such as the underlying conditions, lifestyle choices, or differences in biological responses to certain health issues. On the other hand, the lower percentage of complications in females may be related to protective factors, such as hormonal influences or healthcare seeking behaviour, which warrants further investigation to understand the underlying causes more comprehensively. This difference highlights the importance of considering gender when assessing health risks and planning interventions. Hidalgo NJ et al.[94] observed a slightly higher proportion of male survivors compared to female survivors, with 56,335 males (53.2%) surviving, while 49,533 females (46.8%) survived. Among the non-survivors, the male count was 2,122 (51.1%) and the female count was 2,031 (48.9%). The p-value of 0.007 indicates a statistically significant difference between the survival rates of males and females in our study population. This suggests that the sex of the individuals might play a role in survival outcomes, though the exact cause of this difference should be explored further in future studies. The results are consistent with previous findings in which gender differences have been observed in health outcomes. However, while the difference is significant, it is important to recognize that other

factors could also contribute to the observed survival rates, and further analysis of these variables is needed to better understand the underlying mechanisms.

In our study, the requirement for ICU admission was observed based on the severity of the condition. Out of the total participants, only 2 patients (2.9%) with mild severity required ICU admission. This indicates that mild cases were generally manageable without the need for intensive care. In contrast, 10 patients (14.3%) with moderate severity required ICU care. This reflects the increased need for close monitoring and intervention as the severity of the condition progressed. The highest number of ICU admissions was observed in patients with severe severity, with 20 individuals (28.6%) requiring intensive care. The results suggest a clear correlation between the severity of the condition and the likelihood of requiring ICU admission. The p-value for ICU admission was 0.027, which is statistically significant ($p < 0.05$). This indicates that the severity of the condition had a significant impact on the need for ICU care, with more severe cases showing a higher likelihood of requiring intensive monitoring and treatment. This finding aligns with clinical expectations, as more severe cases tend to present with complications or deteriorating health that necessitate closer management in an ICU setting. We did not find any relevant study which relates to ICU Admission Requirement.

In our study, we aimed to evaluate the distribution of various aetiological factors contributing to the development of the condition under investigation. The data presented reveals that alcohol consumption was identified as the most common factor, accounting for 42.9% of the cases, with 30 individuals reporting this as the primary cause. This finding suggests that alcohol may have a significant role in the development of the condition and should be considered as a key risk factor. The p-value of 0.009 indicates a statistically significant relationship between alcohol consumption and the condition, highlighting its potential importance. Gallstones were the second most common aetiological factor, identified in 25 cases, which represents 35.7% of the total sample. While gallstones are typically known to contribute to various health issues, the relatively high percentage in this study emphasizes the need for further exploration into their specific role in the development of the condition. Hyperlipidaemia, or high cholesterol levels, was found to be a contributing factor in 10 cases, corresponding to 14.3% of the participants. Although less prevalent than alcohol or gallstones, hyperlipidaemia still appears to be an important risk factor and warrants further clinical

attention in individuals with elevated lipid levels. Finally, a small portion of the cases, 7.1% (5 individuals), had an idiopathic cause, where no clear aetiological factor could be identified. This underscores the complexity of the condition and highlights the need for further research to better understand the potential unidentified factors contributing to its development.

In our study, we examined the correlation between complications and mortality among patients. The data revealed significant findings, particularly in relation to the occurrence of pseudocysts, which showed a mortality rate of 2.9%. The p-value for pseudocysts was 0.039, suggesting that the presence of pseudocysts is significantly associated with higher mortality. Furthermore, necrosis and multi-organ failure were also observed to contribute to mortality, each accounting for 5.7% of the cases. While these complications did not show as strong a statistical significance as pseudocysts, they are nonetheless critical factors in the overall mortality observed in the patient cohort. Additionally, our study assessed laboratory parameters to evaluate their role in patient outcomes. Serum amylase levels had a mean value of 210 ± 50.3 with a range of 150–350. The p-value of 0.031 for serum amylase suggests a significant association with clinical outcomes, indicating that elevated levels of this enzyme may be linked to more severe clinical presentations. Similarly, serum lipase, with a mean of 350 ± 80.5 and a range from 200 to 500, also showed notable variability, though its p-value did not reach the level of significance required to draw strong conclusions. Nonetheless, both serum amylase and lipase appear to play crucial roles in the overall clinical assessment of the patient population in this study.

In this study, we assessed various radiological findings, focusing on interstitial oedema, necrosis, and fluid collection, which were observed in a significant portion of the patient. Among the three, interstitial oedema was the most prevalent, observed in 40 cases (57.1%). This finding was statistically significant, with a p-value of 0.014, indicating a strong association with the condition under investigation. Interstitial oedema typically indicates an inflammatory response or altered fluid balance within tissues, which may suggest underlying pathophysiological processes that warrant further clinical attention. Necrosis, which refers to tissue death, was found in 18 cases (25.7%). While less frequent than interstitial oedema, its presence points to more severe tissue damage, potentially resulting from compromised blood supply or other ischemic events. The lower frequency of necrosis compared to oedema may suggest that it occurs

later in the disease progression or in more severe cases. Fluid collection, seen in 12 cases (17.1%), was the least common finding. Fluid accumulation often signals an abnormal process such as infection or inflammation, which could contribute to the clinical symptoms seen in patients. Although it was not as prevalent as oedema or necrosis, fluid collection remains an important finding, particularly in understanding the complexity of the condition. We did not find any relevant study which relates to Imaging Findings.

In our study, we observed the readmission rates of patients categorized by the severity of their condition. The results show that readmission rates increased with the severity of the condition. Among patients with mild severity, only 1.4% were readmitted, while in the moderate severity group, the rate was 5.7%. The highest readmission rate was found in the severe category, with 8.6% of patients being readmitted. The p-value for the mild severity group was 0.045, which indicates a statistically significant difference in readmission rates compared to the other severity groups. This suggests that the severity of the patient's condition plays a crucial role in the likelihood of readmission. The higher the severity, the greater the chance of readmission, which could reflect the complexity of care needed for more severe cases. These findings highlight the importance of closely monitoring patients with more severe conditions to potentially reduce readmission rates by improving follow-up care and management. Ahmed A et al. [96] observed the distribution of patients based on the severity of the condition, using a scoring system to classify severity levels as mild, moderate, or severe. The severity scores ranged from 0 to 10, with mild cases assigned scores between 0 and 3, moderate cases ranging from 4 to 6, and severe cases falling between 7 and 10. Out of the total patients, 41.4% (29 patients) were classified as having mild severity, reflecting that a significant portion of the population experienced a relatively less severe form of the condition. The moderate severity group included 27.1% of patients (19 patients), showing that a substantial proportion also exhibited intermediate symptoms. The severe category, which included 31.4% (22 patients) of the total cases, indicates that nearly a third of the study population experienced severe manifestations of the condition.

In our study, we observed the relationship between various scoring systems and the rates of readmission for patients. One of the key findings was the association between Ranson's score (ranging from 5 to 7) and readmission rates. A total of 4 patients (5.7%) who had a Ranson's score within this range were readmitted, and the result was

statistically significant with a p-value of 0.037. This suggests that a Ranson's score in this range may be a useful predictor for patients at risk of readmission. On the other hand, the Modified CTSI score (ranging from 8 to 10) showed a higher readmission rate, with 6 patients (8.6%) readmitted. However, the p-value for this score was not provided, meaning the association could not be statistically confirmed in this analysis. While the Modified CTSI score indicates a tendency towards higher readmissions, further investigation may be needed to fully understand its predictive value compared to the Ranson's score. Bardakcı O et al. [97] examined two key scoring systems to assess the severity of acute pancreatitis: the Ranson score and the Modified CT Severity Index (CTSI). These scores help clinicians determine the prognosis and guide treatment decisions for patients with acute pancreatitis. The distribution of the Ranson score showed that 37.7% of patients had a score of ≥3, indicating a higher severity of the disease, while the remaining 62.3% had a score of <3, suggesting a relatively milder form of acute pancreatitis. A higher Ranson score is typically associated with an increased risk of complications and a worse clinical outcome. Regarding the Modified CTSI, most patients (94.3%) had a score of ≤4, indicating mild to moderate pancreatic inflammation. Only a small percentage (5.7%) of patients had a score of >4, which typically corresponds to severe pancreatic involvement and a greater likelihood of complications such as pancreatic necrosis or organ failure. This distribution aligns with findings from previous studies, which show that a majority of acute pancreatitis cases tend to be mild in severity, with only a small proportion of patients experiencing severe complications.

SUMMARY AND CONCLUSION

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CONCLUSION

- The majority of study participants were males aged between 31–45 years, predominantly from the lower middle class, with most having a secondary level of education.
- Gender differences were evident in the frequency of complications, with males experiencing a higher rate of complications compared to females.
- Alcohol was identified as the most prevalent aetiological factor in patients with cholelithiasis, followed by gallstones.
- Complications like necrosis and pseudocysts were notably frequent among patients with pancreatitis, with specific complications significantly impacting survival outcomes.
- Statistical analysis demonstrated significant differences in survival rates, with 85.7% of participants surviving and a notable correlation between higher Ranson's Scores and increased mortality.
- Severity of the condition significantly correlated with longer hospital stays and higher Intensive Care Unit (ICU) admission rates, especially for severe cases.
- Ranson's Score and the Modified Computed Tomography Severity Index (CTSI) Score effectively assessed the severity of pancreatitis, with higher scores correlating with increased severity and higher mortality rates.
- The distribution of serum amylase and lipase levels showed significant variations, which are useful for diagnostic assessments.
- Readmission rates were correlated with the severity of the condition and specific scoring criteria, indicating a need for careful monitoring and management post-discharge to prevent readmissions.

LIMITATION

1. The sample size of 70 patients might be too small to generalize the findings broadly across different populations or to detect small but clinically significant differences between the two scoring systems.
2. The use of a convenient sampling technique may introduce selection bias, limiting the representativeness of the sample.
3. The study design is observational, which inherently limits the ability to establish causality between the scoring systems and patient outcomes.
4. The study relies on the accuracy and completeness of the data recorded in medical records, which might have variability in the quality and depth of information.
5. Limited demographic diversity within the study population at a single hospital may not reflect the broader population, potentially affecting the external validity of the findings.
6. Potential confounding variables that could influence the outcomes were not controlled, which might affect the reliability of the results.
7. The study did not include patients under 18 years or those with chronic pancreatitis, which excludes a significant portion of the pancreatitis population and may limit the applicability of the results.
8. Data analysis was limited to statistical tests provided by specific software (SPSS), which might restrict more advanced or varied analytical approaches that could offer deeper insights.
9. The reliance on patient consent and potential refusal could lead to a participation bias, where those included might differ in significant ways from those who refused.
10. The ethical constraints and strict inclusion/exclusion criteria could also limit the scope of the study and the ability to explore additional relevant outcomes.

SUMMARY

The study, conducted at Santosh Medical College and Hospital, Ghaziabad, was an observational analysis over 18 months, aiming to compare the effectiveness of Ranson's score and the Modified Computed Tomography Severity Index (MCTSI) in predicting mortality and complications in patients with acute pancreatitis. This research was prompted by the significant variability in the clinical presentations of acute pancreatitis, ranging from mild, self-limiting disease to severe, life-threatening conditions that require differentiated management strategies based on the severity at presentation.

Seventy patients admitted with acute pancreatitis were enrolled following ethical approval and informed consent, adhering strictly to inclusion criteria while excluding minors, those refusing participation, and patients with chronic pancreatitis. The methodologies involved detailed data collection regarding demographic and clinical parameters, input into a Microsoft Excel database for robust analysis using statistical software like SPSS and Stata MP-17. The statistical approach included one-sample Kolmogorov-Smirnov tests to assess data normality, T-tests, and Chi-Square tests for comparative analyses, emphasizing the importance of a p-value less than 0.05 for statistical significance.

The findings from this study highlighted that both Ranson's score and MCTSI have their merits in clinical settings, with each providing critical insights into patient prognosis at different stages of hospital care. However, the results indicated a nuanced superiority of one scoring system over the other in specific aspects of predicting patient outcomes. Ranson's score, which assesses physiological and biochemical markers at admission and 48 hours later, was particularly noted for its practical utility in settings lacking advanced diagnostic tools. In contrast, MCTSI, which incorporates CT findings with clinical parameters, offered a more detailed assessment of the anatomical and functional severity of pancreatitis, potentially guiding more tailored and aggressive interventions.

Comparative analysis showed that while both scoring systems were effective in predicting the severity of acute pancreatitis, differences in their predictive accuracy for specific complications like necrosis and organ failure were evident. These findings suggest potential areas for improving the existing scoring systems or developing new tools that combine the strengths of both Ranson's score and MCTSI.

The study acknowledged limitations such as the small sample size and the hospital-based setting, which might not fully represent the general population. Furthermore, the use of convenience sampling might introduce selection bias, affecting the generalizability of the results. Ethical considerations were meticulously followed throughout the study, with detailed informed consent processes ensuring the ethical integrity of the research.

In conclusion, the study not only reinforced the value of both Ranson's score and MCTSI in managing acute pancreatitis but also highlighted the need for ongoing research to refine these tools. Future studies could focus on larger, more diverse patient populations and explore the integration of novel biomarkers or imaging techniques to enhance predictive accuracy and clinical utility. Such advancements could lead to more personalized care strategies and potentially better outcomes for patients suffering from this challenging and unpredictable disease.

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ANNEXURES

SANTOSH MEDICAL COLLEGE & HOSPITAL

Details of Patient Information Sheet Human Subject Research Proposal:-

Subject ID Number:

Name of Researcher: Dr. Ravi Shankar
Department: Department of General Surgery
Title of Project: "COMPARATIVE STUDY OF RANSONS CRITERIA AND MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX (MCTSI) IN PREDICTING COMPLICATIONS AND MORTALITY IN ACUTE PANCREATITIS**".**

Description of Human Subjects Safeguards and Rights:

A general biodata of the patients regarding their name, age, sex, occupation, religion, socio-economic status and address will be collected.

Any significant past history will also be taken into account. A routine general physical and systemic examination will be performed. Routine lab investigations will be sent, including serum lactate dehydrogenase (LDH) levels, serum aspartate aminotransferase (AST) level, decrease in hematocrit levels, increase in blood urea nitrogen, serum calcium levels, partial oxygen pressure (PaO2) levels. A fully explained well informed consent will be taken from all patients. Patients will be assigned an ID no.

The analyzed data will be compared with other series in literature and discussed. A master chart dealing with all aspects will be designed and presented. A proforma will be used for the study purpose.

There is no risk of psychological or physical harm to the patients directly related to the nature or methodology of the study.

Subjects are free to choose to leave the study at any point and are free to choose to stop receiving negative pressure wound therapy or conventional normal saline dressing as a part of the study, at which point, their participation in the study will be terminated and their data will not be used. Subjects will receive their collected study information.

PERFORMA FOR ACUTE PANCREATITIS

NAME; AGE: SEX: PHONE NO:

ADDRESS:

D.O.A:

COMPLAINTS:

HISTORY OF PRESENT ILLNESS:

HISTORY OF PAST ILLNESS:

GENERAL EXAMINATION:

ABDOMEN EXAMINATION:

- Inspection
- Palpation
- Percussion
- Auscultation

SERUM AMLYASE:

SERUM LIPASE:

RADIOLOGICAL FINDINGS (USG/CT/XRAY):

1. RANSON SCORE

ADMISSION	VALUE	SCORE
i. AGE		
ii. W.B.C:		
iii. BLOOD SUGAR:		
iv. AST:		
v. LDH:		

48hrs		
i. HEMATOCRIT DECLINE:		
ii. BUN INCREASE		
iii. FLUID REPLACED		
iv. PAO2		
v. SERUM CALCIUM		

FINAL SCORE:

2. MODIFIED CTSI:

PANCREATIC INFLAMMATION	**SCORE**	**OBSERVATION**
No inflammatory changes	0	
Parenchymal inflammation and/or peri pancreatic fat stranding	2	
Peri pancreatic collection	4	
PANCREATIC NECROSIS		
No necrosis	0	
<30% necrosis	2	
>30% necrosis	4	
EXTRA PANCREATIC COMPLICATION		
none	0	
Ascites/pleural effusion/GI involvement	2	
TOTAL SCORE		

	YES	NO
MORTALITY		

COMPLICATIONS	**PRESENT**	**ABSENT**
PANCREATIC NECROSIS		
PSEUDOCYST		
ACUTE RESPIRATORY FAILURE		
MODS		

संतोष मेडिकल कॉलेज एवं अस्पताल (गाजियाबाद)

सहमति पत्र (सूचित)

मैं _____ बेटा/ बेटी/ पत्नी_____निवासी

_____ घोषणा करता हूं कि डॉ ._____, ने मुझे मेरी भाषा में अपने अध्ययन "COMPARATIVE STUDY OF RANSONS CRITERIA AND MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX(MCTSI) IN PREDICTING COMPLICATIONS AND MORTALITY IN ACUTE PANCREATITIS" के उद्देश्य के बारे में, और अध्ययन के दौरान अपनाई जाने वाली विभिन्न प्रयोगशाला जांच के बारे में सूचित कर दिया है। मुझे अध्ययनकी अवधि और उसके दौरान अपनाए जाने वाले निर्देश भी मेरी भाषा मे समझा दिए गए हैं| मैं उपरोक्त अध्ययन में बिना किसी दबाव के दाखिला ले रहा हूं और पूर्ण सहमति दे रहा हूं | सन्तोष अस्पताल, गाजियाबाद में अपने आगे के उपचार पर बिना प्रतिकूल प्रभाव डाले इस अध्ययन से और प्रयोगशाला जांच की प्रकृति से मैं जब चाहूँ बाहर जाने के अपने अधिकार को सुरक्षित रख रहा हूं |

रोगी / रोगी के रिश्तेदार के हस्ताक्षर डॉक्टर के हस्ताक्षर

नाम

दिनांक:

मेरी उपस्थिति में मरीज ने पूरी तरह से डॉक्टर के बताए गए अध्ययन और निर्देशों को समझने के बादअपनी स्वतंत्र इच्छा से ऊपर के फार्म पर हस्ताक्षर किए हैं ।

हस्ताक्षर

नाम: **डॉ रवि शंकर**

पदनाम: पीजी

शल्य चिकित्स विभाग

INFORMED CONSENT

I, _____ Son/Daughter/Wife of _____ resident of _____hereby declare that I give my full, free and voluntary informed consent in the thesis - "COMPARATIVE STUDY OF RANSONS CRITERIA AND MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX (MCTSI) IN PREDICTING COMPLICATIONS AND MORTALITY IN ACUTE PANCREATITIS**".**

I, Dr._____ has informed me to my full satisfaction, in the language I understand, about the purpose, nature of study and various laboratory investigations for the study to be carried out. I have been informed about the duration of the study and instructions to be followed during the study period.

I give full consent for being enrolled in the above study and I reserve my rights to withdraw from this study, whenever I wish without prejudice of my right to undergo further treatment at Santosh Hospital, Ghaziabad U.P.

Patient's/ Patient's relative's signature Doctors signature

Or thumb impression

Name: Date:

We have witnessed that the patient signed the above form in the presence of his free will after fully understanding its content.

Signature of Investigator

Signature of Witness,

Name: Dr. Ravi Shankar

Name, Designation: PG Department of General Surgery

Contact No.-7760010274

ETHICAL COMMITTEE CLEARANCE

SANTOSH
Deemed to be University
(Established u/s 3 of the UGC Act, 1956)

F. No. SU/R/2023/2489[40] Dated: 26.09.2023

Subject: Grant of Ethical Clearance for **Thesis Protocol** Topic **"COMPARATIVE STUDY OF RANSONS CRITERIA AND MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX (MCTSI) IN PREDICTING COMPLICATIONS AND MORTALITY IN ACUTE PANCREATITIS",** submitted by **Dr. RAVI SHANKAR,** MD/MS student of Batch 2022-2023, Department of **GENERAL SURGERY.**

*****

With reference to his/her request for grant of Ethical Clearance for the Thesis Protocol entitled **"COMPARATIVE STUDY OF RANSONS CRITERIA AND MODIFIED COMPUTED TOMOGRAPHY SEVERITY INDEX (MCTSI) IN PREDICTING COMPLICATIONS AND MORTALITY IN ACUTE PANCREATITIS", Dr. RAVI SHANKAR** is informed that the **Thesis Protocol** submitted by him/her was considered by the **Screening Committee** of the Santosh Medical College & Hospital in its meetings held on 17.07.2023 to 28.07.2023. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **23.09.2023** and the same was **approved** by the **Ethics Committee.**

He /She is informed accordingly for further necessary action.

[Dr. NARESH SHARMA]
REGISTRAR

SANTOSH "DEEMED TO BE UNIVERSITY" REGISTRAR GHAZIABAD, NCR INDIA

Dr. RAVI SHANKAR
MD/MS student of batch 2022-2023
Department of GENERAL SURGERY
Email: rs0402458@gmail.com

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ANTI PLAGIARISM CERTIFICATE

Dr. Ravi Shankar

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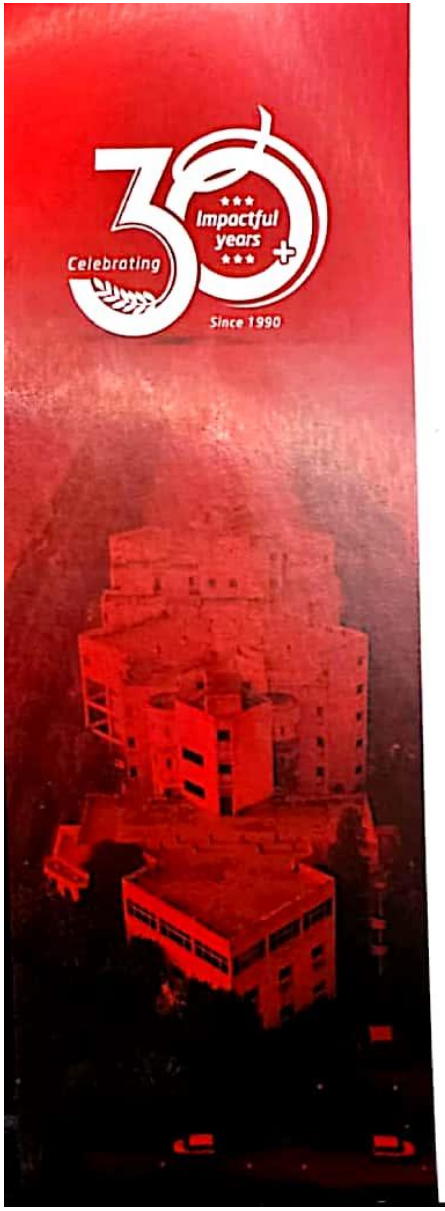

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Vice Chancellor

MASTER CHART

S.No.	IPD No	Name	Gender	Age Group (years)				Socioeconomic Status				Education Level	Ranson's Score	Modified CTSI Score	Complications				Survival Outcome	Ranson's Score and Mortality Rate		Modified CTSI Score and Mortality Rates		Severity of Condition			Severity of Illness and ICU Admission Rates			Distribution of Aetiology				Complications in Patients	Serum Amylase	Serum Lipase	Findings on CT			Comparison of Readmission Rates by Ranson's Score and Modified CTSI Score	
				18–30	31–45	46–60	>60	Upper Class	Upper Middle Class	Lower Middle Class	Upper Lower Class				Pseudocyst	Necrosis	ARDS	Multi-Organ Failure		Ranson's Score (2–4)	Ranson's Score (5–7)	Modified CTSI Score (3–5)	Modified CTSI Score (6–10)	Mild	Moderate	Severe	Mild	Moderate	Severe	Alcohol	Gallstones	Hyperlipidaemia	Idiopathic				Interstitial Oedema	Necrosis	Fluid Collection	Ranson's Score (5–7)	Modified CTSI Score (8–10)
1	17274962	Amreen	Female	No	No	Yes	No	No	Yes	No	No	Graduate and Above	3	7	No	No	Yes	No	Survivors	No	No	No	No	4.6	8.6	16.7	No	No	No	Yes	No	No	No	N/A	241	280	Yes	No	No	No	No
2	17274928	Jai Prakash	Male	Yes	No	No	No	No	No	No	Yes	Illiterate	4	5	Yes	No	No	No	Survivors	No	Yes	No	No	7.7	10.7	14.8	No	Yes	No	No	Yes	No	No	Multi-Organ Failure	176	393	No	Yes	No	No	Yes
3	17276214	Kasheem	Male	Yes	No	No	No	No	Yes	No	No	Primary	4	6	No	Yes	No	No	Survivors	No	No	No	No	7.6	9	13.9	No	No	Yes	Yes	No	No	No	N/A	216	313	Yes	No	No	No	No
4	17275885	Raj Kumar	Male	No	No	No	Yes	No	No	Yes	No	Secondary	3	8	Yes	No	No	No	Survivors	No	No	No	Yes	6.3	11.5	12.3	No	No	No	No	No	No	Yes	N/A	201	323	No	No	Yes	No	No
5	17276536	Dharmendra	Male	No	Yes	No	No	Yes	No	No	No	Graduate and Above	5	7	No	No	No	Yes	Non-survivors	No	No	No	No	5.6	7.8	13.5	No	No	Yes	No	Yes	No	No	N/A	255	299	Yes	No	No	Yes	No
6	17276682	Kamla	Female	No	No	Yes	No	No	No	Yes	No	Illiterate	5	6	No	Yes	No	No	Survivors	Yes	No	No	No	7	11.6	13.9	No	No	No	Yes	No	No	No	Pseudocyst	235	322	No	Yes	No	No	No
7	17283676	Sudhir Kumar	Male	Yes	No	No	No	No	Yes	No	No	Primary	4	5	Yes	No	No	No	Survivors	No	No	No	No	7.7	13.2	14.2	No	Yes	No	No	Yes	No	No	N/A	237	283	Yes	No	No	No	No
8	17283314	Kunwar Pal	Male	Yes	No	No	No	No	No	No	Yes	Secondary	3	8	No	Yes	No	No	Survivors	No	No	No	Yes	6.9	9	12.5	No	No	No	Yes	No	No	No	N/A	222	357	Yes	No	No	No	No
9	17212342	Kunal Verma	Male	No	No	Yes	No	No	No	Yes	No	Illiterate	3	7	Yes	No	No	No	Survivors	No	No	No	No	6.3	10.9	15.6	No	No	Yes	No	No	Yes	No	N/A	221	411	No	Yes	No	No	No
10	17223452	Vihaan Patel	Male	Yes	No	No	No	No	Yes	No	No	Graduate and Above	4	5	No	No	Yes	No	Survivors	No	No	No	No	6.7	11.7	17	No	Yes	No	Yes	No	No	No	N/A	168	428	No	No	Yes	No	No
11	17279295	Naziya	Female	No	No	No	Yes	No	No	No	Yes	Primary	5	6	Yes	No	No	No	Survivors	No	No	No	No	6.5	11.5	17.7	Yes	No	No	No	Yes	No	No	N/A	245	387	Yes	No	No	No	No
12	17277065	Sunita	Female	Yes	No	No	No	No	No	Yes	No	Illiterate	4	8	No	Yes	No	No	Survivors	No	No	No	No	6.3	9.5	14.9	No	No	No	No	Yes	No	No	Multi-Organ Failure	196	389	Yes	No	No	No	No
13	17389037	Vivaan Singh	Male	No	No	Yes	No	No	Yes	No	No	Secondary	3	7	No	No	No	No	Non-survivors	No	Yes	No	No	8.2	9	12.6	No	No	No	Yes	No	No	No	N/A	171	379	Yes	No	No	No	No
14	17234569	Rishi Prasad	Male	No	Yes	No	No	No	No	No	Yes	Primary	3	5	Yes	No	No	No	Survivors	No	No	No	No	5.6	11.9	18.4	No	No	No	Yes	No	No	No	N/A	225	293	Yes	No	No	No	Yes
15	17345649	Pranav Agarwal	Male	Yes	No	No	No	No	No	Yes	No	Primary	5	6	No	No	No	No	Survivors	No	No	No	No	7.5	10.9	16.8	No	No	Yes	No	Yes	No	No	N/A	211	316	Yes	No	No	No	No
16	17412391	Chetan Patel	Male	No	No	No	Yes	No	Yes	No	No	Illiterate	5	8	No	Yes	No	No	Non-survivors	No	No	No	No	8.1	10.1	14.7	No	No	No	Yes	No	No	No	Necrosis	167	421	No	No	Yes	No	No
17	17345679	Divya Mukherjee	Female	No	Yes	No	No	No	Yes	No	No	Primary	4	7	Yes	No	No	No	Survivors	No	No	Yes	No	5.1	9.8	15.5	No	No	No	Yes	No	No	No	N/A	236	311	No	Yes	No	No	No
18	17334566	Ayaan Desai	Male	No	No	Yes	No	No	No	No	Yes	Graduate and Above	4	5	No	No	No	No	Survivors	Yes	No	No	No	4.2	9.2	12	No	No	Yes	Yes	No	No	No	N/A	178	398	Yes	No	No	No	No
19	17234467	Ishwar Deshmukh	Male	Yes	No	No	No	Yes	No	No	No	Secondary	3	6	Yes	No	No	No	Survivors	No	No	No	No	5.7	12.6	13.4	No	No	No	No	Yes	No	No	N/A	188	327	Yes	No	No	No	No
20	17234893	Arjun Gupta	Male	No	No	No	Yes	No	Yes	No	No	Primary	4	8	No	Yes	No	No	Survivors	No	No	No	Yes	7	11.7	17.7	No	Yes	No	No	Yes	No	No	Multi-Organ Failure	220	369	No	No	Yes	No	No
21	17327869	Tejas Mehta	Male	Yes	No	No	No	No	No	Yes	No	Illiterate	4	7	No	No	No	No	Survivors	No	No	No	No	6.3	13	18.3	No	No	No	Yes	No	No	No	N/A	207	319	Yes	No	No	Yes	No
22	17245678	Prisha Bhat	Female	No	No	Yes	No	No	No	No	Yes	Primary	5	5	Yes	No	No	No	Survivors	No	Yes	No	No	6.7	8.2	15	No	No	Yes	No	No	No	Yes	N/A	227	328	No	Yes	No	No	No
23	17366571	Anvi Singh	Female	No	Yes	No	No	No	No	Yes	No	Secondary	3	6	No	No	No	Yes	Non-survivors	No	No	No	No	4.8	11.8	15.4	No	No	No	Yes	No	No	No	Necrosis	243	335	Yes	No	No	No	No
24	17462516	Shivam Dutta	Male	Yes	No	No	No	No	Yes	No	No	Graduate and Above	5	8	Yes	No	No	No	Survivors	No	No	No	No	5.7	10.6	12.6	No	Yes	No	No	Yes	No	No	N/A	207	340	Yes	No	No	No	No
25	17657892	Naresh Sinha	Male	No	Yes	No	No	No	No	No	Yes	Primary	4	7	No	Yes	No	No	Survivors	No	No	No	No	5.5	11.1	12.6	No	No	No	No	No	Yes	No	N/A	202	312	No	Yes	No	No	No
26	17453891	Nikhil Bhat	Male	Yes	No	No	No	No	No	No	Yes	Illiterate	5	5	No	No	Yes	No	Survivors	No	No	No	No	7.4	8.1	13.6	No	No	Yes	Yes	No	No	No	N/A	244	289	Yes	No	No	No	No
27	17377111	Om Deshmukh	Male	No	No	Yes	No	No	Yes	No	No	Primary	3	6	No	No	No	No	Survivors	No	No	No	No	5.1	12.1	13.3	No	No	No	No	Yes	No	No	N/A	243	325	No	No	Yes	No	No
28	17456782	Ananya Singh	Female	No	No	No	Yes	No	No	Yes	No	Secondary	5	8	No	Yes	No	No	Survivors	No	No	No	No	6.7	11.1	12.9	No	No	No	No	No	Yes	No	N/A	191	286	Yes	No	No	No	Yes
29	17345980	Esha Gupta	Female	Yes	No	No	No	No	No	No	Yes	Graduate and Above	4	7	No	No	Yes	No	Survivors	Yes	No	No	No	6.9	13	13.6	No	No	No	Yes	No	No	No	N/A	187	343	No	Yes	No	No	No
30	17300235	Aditya Kumar	Male	No	Yes	No	No	No	Yes	No	No	Secondary	3	5	No	No	No	No	Survivors	No	No	No	Yes	7.4	12.1	15.2	No	No	Yes	No	Yes	No	No	N/A	212	338	Yes	No	No	No	No
31	17262856	Yash Sinha	Male	No	No	Yes	No	No	No	Yes	No	Primary	3	6	No	Yes	No	No	Survivors	No	No	No	No	6.1	11.2	12	No	No	No	No	Yes	No	No	N/A	184	392	No	No	Yes	No	No
32	17262845	Aarav Sharma	Male	Yes	No	No	No	Yes	No	No	No	Illiterate	4	8	No	No	No	No	Non-survivors	No	No	No	No	5.1	11.7	17.1	No	No	No	Yes	No	No	No	N/A	176	388	No	Yes	No	No	No
33	17293856	Rudra Kulkarni	Male	No	No	No	Yes	No	No	No	Yes	Secondary	5	7	Yes	No	No	No	Survivors	No	No	No	No	6.6	11.6	14.5	No	Yes	No	Yes	No	No	No	N/A	217	402	Yes	No	No	No	No
34	17441416	Mishba	Female	Yes	No	No	No	No	Yes	No	No	Primary	4	5	No	No	No	No	Survivors	No	No	No	No	4.8	11.6	14.4	No	No	No	No	Yes	No	No	N/A	236	281	No	No	Yes	No	No
35	17456584	Mridula	Female	No	Yes	No	No	No	No	No	Yes	Secondary	3	6	No	Yes	No	No	Survivors	No	No	No	No	4.8	11.1	17.4	No	No	Yes	No	No	Yes	No	N/A	214	393	Yes	No	No	No	No
36	17286917	Girish Sharma	Male	No	No	Yes	No	No	Yes	No	No	Graduate and Above	3	8	No	No	Yes	No	Survivors	No	No	No	No	4.2	12.4	17.7	No	No	Yes	Yes	No	No	No	N/A	186	319	Yes	No	No	No	No
37	17236688	Suresh Varma	Male	No	Yes	No	No	No	Yes	No	No	Primary	4	7	Yes	No	No	No	Survivors	No	No	No	No	5	11.5	16.8	No	No	No	No	Yes	No	No	N/A	203	272	No	Yes	No	No	Yes
38	17438210	Hrithik Joshi	Male	Yes	No	No	No	No	No	Yes	No	Primary	5	5	No	Yes	No	No	Survivors	No	Yes	No	No	8	9.4	12.8	No	No	Yes	No	No	No	Yes	N/A	208	331	Yes	No	No	No	No
39	17436578	Vijay Mehta	Male	No	Yes	No	No	No	No	No	Yes	Illiterate	4	6	No	No	No	Yes	Survivors	No	No	No	No	4.6	8.1	14.6	Yes	No	No	Yes	No	No	No	Multi-Organ Failure	244	381	No	Yes	No	No	No
40	17398676	Shreya Kapoor	Female	Yes	No	No	No	No	No	Yes	No	Secondary	3	8	Yes	No	No	No	Survivors	No	No	No	No	4.2	9.3	14.6	No	No	No	No	Yes	No	No	N/A	206	429	Yes	No	No	Yes	No
41	17542612	Bano Khatoon	Female	No	No	Yes	No	No	Yes	No	No	Primary	4	7	No	Yes	No	No	Survivors	No	No	No	Yes	7.5	9.5	18.3	No	No	Yes	No	Yes	No	No	N/A	222	405	No	Yes	No	No	No

MASTER CHART

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